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Errata

Page 90, line 9, for monotypic read monotopic.
Page 90, line 15, for polytypic read polytopic.
Page 116, line 11 from bottom, for *gloxinioides* read *gloxiniæflora*.
Page 226, line 17 from bottom, for cells read cell.
Page 237, line 10, for 2 read 2^1.
Page 463, line 18, for *Dasiphora* read *Dasiophora*.
Page 470, line 10, for *Lloydea* read *Lloydia*.

Vol. 41 No. 1

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JANUARY, 1914

Studies of West Indian plants—V

NATHANIEL LORD BRITTON

23. ADDITIONAL SEDGES FROM JAMAICA*

CYPERUS COMOSUS Poir. in Lam. Encycl. 5: 185. 1817

Shettlewood, Hanover (*Harris 11647*).

DISTRIBUTION: Cuba; continental tropical America.

SCIRPUS CUBENSIS Kunth, Enum. 2: 172. 1837

River Head, near Ewarton (*Underwood 1860*).

DISTRIBUTION: Southern United States; Cuba; Hispaniola; Trinidad; continental tropical America; tropical Africa.

RYNCHOSPORA CYMOSA (Michx.) Ell. Bot. S. C. and Ga. 1: 58. 1816

Savannah, Upper Clarendon (*Harris 11103*).

DISTRIBUTION: Southeastern United States; Cuba; Hispaniola; Porto Rico; Martinique; South America.

Rynchospora jamaicensis sp. nov.

Rootstocks short; culms clustered, slender, 6–8 dm. long, reclining. Leaves 2–3 mm. wide, rather stiff, the lower 2–5 cm. long, the middle ones 12–15 cm. long, those subtending the clusters of spikelets 6–10 cm. long; sheaths of all the leaves densely short-pubescent; spikelets loosely panicled in several distant axillary clusters and in a terminal one, short-pedicelled, the axis of the inflorescence loosely pubescent; spikelets narrowly conic, 4–5 mm.

* See Bull. Dept. Agric. Jam. 5: Suppl. 1. 1907. Bull. Torrey Club 35: 568, 569. 1909.

[The BULLETIN for December (40: 653–712. *pl. 25, 26*) was issued 8 Ja 1914.]

long, maturing 2 achenes; lower empty scales broadly ovate, the others lanceolate, acuminate; bristles none; achenes obovate-orbicular, 1 mm. long, pale brown, shining, finely cancellate; tubercle triangular-lanceolate, acuminate, flat, about one-third longer than the achene, its base nearly truncate.

Rocky banks in the Blue Mountains of Jamaica; *type*, from Hardware Gap, *N. L. Britton 3322*, collected Sept. 9, 1908. Related to *R. elongata* (Boeckl.) Clarke, and to *R. polyphylla* Vahl, but at once distinguished from them by its pubescent sheaths.

24. THE GENUS PITHECOLOBIUM IN CUBA

A. Pods curved or coiled, dehiscent, the valves twisting after separating.

1. Seeds with a fleshy aril; stipules spinescent; pinnae 1 or 2 pairs; leaflets 2–4 pairs.
   - Leaflets 1–6 cm. long (species perhaps confluent).
     - Leaflets spinulose-mucronate. — 1. *P. circinale.*
     - Leaflets obtuse or mucronulate.
       - Leaflets chartaceous; petioles of the lower leaves, at least, longer than the petiolules. — 2. *P. Unguis-cati.*
       - Leaflets coriaceous; petioles shorter than the petiolules or as long.
         - Petioles and petiolules stout; leaflets large, 2.5–6 cm. long. — 3. *P. guadalupense.*
         - Petioles and petiolules slender; leaflets small, 1–3 cm. long. — 4. *P. bahamense.*
   - Leaflets only 3–7 mm. long. — 5. *P. Hystrix.*
2. Seeds without a fleshy aril; stipules not spinescent; pinnae 2 pairs or more; leaflets 3 pairs or more.
   1. Leaflets obovate to oval, large, 1.5–6 cm. long, 3–6 pairs to each pinna.
      - Calyx subtruncate at base; seeds oblong, about twice as long as wide. — 6. *P. savannarum.*
      - Calyx narrowed at base; seeds suborbicular to obovate.
        - Pinnae 3 or 4 pairs; leaflets 4–6 pairs; calyx narrowly campanulate, thin. — 7. *P. discolor.*
        - Pinnae 1 or 2 pairs; leaflets 2–4 pairs; calyx broadly campanulate, coriaceous.
          - Calyx truncate, its teeth minute, mucronulate. — 8. *P. truncatum.*
          - Calyx teeth large, broadly ovate.
            - Calyx short-campanulate; stamen-tube short; leaflets broadly obovate. — 9. *P. obovale.*
            - Calyx long-campanulate; stamen-tube 5–6 mm. long; leaflets oblong to obovate. — 10. *P. pinetorum.*

2. Leaflets linear to oblong, small, 5–16 mm. long, 6–many pairs to each pinnule.
Leaflets 2–3 mm. long, oblong, coriaceous. 11. *P. nipense.*
Leaflets 5–16 mm. long, thin, dull.
Leaflets obliquely oblong, narrowed at base. 12. *P. asplenifolium.*
Leaflets linear, linear-lanceolate or oblong, obtuse, rounded or subcordate at the base.
Leaflets oblong, 5–7 mm. long. 13. *P. trinitense.*
Leaflets linear.
Pinnae 2 pairs; leaflets acute, strongly veined; pod compressed. 14. *P. guantanamense.*
Pinnae 3–11 pairs; leaflets obtuse, not strongly veined; pod swollen. 15. *P. arboreum.*

B. Pods straight, or curved, indehiscent, or dehiscent, the valves not twisting.

Unarmed trees.
Pod straight or a little curved, compressed, turgid, fleshy; leaflets oblong to obovate, large. 16. *P. Saman.*
Pod straight, thin, very flat, chartaceous; leaflets linear, small, very numerous. 17. *P. Berterianum.*
Trees or shrubs, armed with spinescent stipules (*P. tortum* sometimes unarmed).
Pod coriaceous, tardily dehiscent; stamens 2 cm. long or less, the tube short; leaflets many; spines straight. 18. *P. tortum.*
Pod chartaceous, thin and flat, dehiscent; stamens 5–6 cm. long, the tube much exserted; leaflets few; spines curved. 19. *P. prehensile.*

1. PITHECOLOBIUM CIRCINALE (L.) Benth. Lond. Journ. Bot. 3: 201. 1844

Mimosa circinalis L. Sp. Pl. 517. 1753.

Thickets in dry districts at low elevations, southern Oriente; Hispaniola.

Bentham's record of this species for the Bahamas appears to refer to *P. mucronatum* Britton, which has quite different leaves. The Oriente plant differs from the typical one of Hispaniola in having smaller, thicker leaflets, less cuneate at the base, and is either glabrous or densely pubescent.

2. PITHECOLOBIUM UNGUIS-CATI (L.) Mart. Hort. Monac. 188. 1829

Mimosa Unguis-cati L. Sp. Pl. 517. 1753.

Cayo Sabinal, Camagüey (*Shafer* 1063); recorded by Richard as in various parts of the island, but is apparently rare. West Indies (except Bermuda); northern South America.

3. PITHECOLOBIUM GUADALUPENSE Chapm. Fl. S. U. S. 116. 1860

Cays of Camagüey; Bahamas; Florida Keys.

4. PITHECOLOBIUM BAHAMENSE Northrop, Mem. Torrey Club 12: 38. 1909

Cays of Camagüey; Bahamas.

5. PITHECOLOBIUM HYSTRIX (A. Rich.) Benth. in Hook. Icon. Pl. *pl. 1168.* 1876

Inga Hystrix A. Rich. Ess. Fl. Cub. 1: 471. 1845.

Pithecolobium calliandrifolium C. Wright; Griseb. Cat. Pl. Cub. 83. 1866.

Coastal thickets and hillsides: Camagüey, Santa Clara, Havana, Pinar del Rio; Bahamas.

6. **Pithecolobium savannarum** sp. nov.

A tree up to 7 m. high, with smooth bark, the foliage finely and densely puberulent when young, glabrous or sparingly puberulent when old. Leaves 1.5–2 dm. long, the rather stout petioles 1–2.5 cm. long, the glands somewhat elevated; pinnae about 4 pairs, the petiolules slender, 2 cm. long or less; leaflets 4–6 pairs, obliquely obovate, 1.5–3 cm. long, chartaceous, loosely reticulate-veined, deep green and somewhat shining above, pale and dull beneath, obtuse or retuse at the apex, acute at the base; peduncles axillary, slender, striate, glabrous, 7–9 cm. long; flowers short-racemose, white; pedicels slender, glabrous, 3–6 mm. long; calyx 3–4 mm. long, subtruncate at the base, campanulate, its teeth acute, ovate, often somewhat unequal; corolla funnelform, appressed-pubescent, 8 mm. long, its lobes ovate-oblong; stamens 15 mm. long, united about one-third their length; ovary and young pod densely pubescent; old pods 8–10 cm. long, the valves doubly coiled after dehiscence, moniliform, 4–6 mm. wide across the seed cavities, 2 mm. wide between them; seed cavities oblong, 8–10 mm. long.

Along a water course on barren savannas southeast of Holguin, Oriente, April 7, 1909 (*Shafer 1194*).

7. **Pithecolobium discolor** sp. nov.

A shrub 3 m. high, or a small tree up to 7 m. high, the young twigs and leaves densely puberulent, the old leaves glabrous or

somewhat puberulent, 1–2 dm. long, the stout petioles 2 cm. long or less, the glands on the rachis between the pinnae orbicular, small. Pinnae 3 or 4 pairs; leaflets 4–6 pairs, obovate, chartaceous, 1.5–2.5 cm. long, dark green above, pale beneath, loosely reticulate-veined, obtuse or retuse at the apex, obliquely narrowed at the base; peduncles axillary, puberulent above, 5–11 cm. long; flowers short-racemose; pedicels puberulent, 4–6 mm. long; calyx narrowly campanulate, 4–5 mm. long, narrowed to the base, puberulent, its teeth ovate, 1 mm. long; corolla 7–8 mm. long, campanulate-funnelform, pubescent, its lobes oblong-ovate, ciliate; stamens 1.5–2 cm. long, the filaments united about one-fourth their length; pod coiled, 6–8 cm. long, 8–10 mm. wide, more or less constricted between the seeds; seeds blue and white, shining, orbicular, 4 mm. broad, the funicle slender.

Provinces of Havana, Pinar del Rio and Camagüey. Type from Batabano, April 10, 1903 (*Shafer 161*); apparently the same species at Old Kerr's Point, Abaco, Bahamas (*Brace 2017*).

8. **Pithecolobium truncatum** sp. nov.

A tree up to 12 m. high, the bark rough, the young twigs and leaves brownish-puberulent, the old foliage glabrous. Leaves 15 cm. long or less; petiole stout, 1–2 cm. long; glands oblong-orbicular; pinnae 1 or 2 pairs; leaflets 3 or 4 pairs (on leaves of shoots 1 or 2 pairs), obovate, coriaceous, 1.5–4 cm. long (those of shoots larger and suborbicular), obtuse at the apex, narrowed at the base, pinnately veined; peduncles axillary, 4–9 cm. long; flowers short-racemose; pedicels stout, puberulent, about 2 mm. long; calyx broadly campanulate, puberulent, coriaceous, 3 mm. long, the limb truncate, the teeth minute, mucronate; corolla finely pubescent, its tube 5–6 mm. long, its lobes 3 mm. long, lanceolate, acute; stamens about 2.5 cm. long, the filaments united about one-fourth their length; pod curved to a nearly complete circle, 6 or 7 cm. long, 8–10 mm. wide, scarcely or not at all constricted between the seeds; seeds blue and white, somewhat compressed, obovate, shining, 4 or 5 mm. long.

Southern Oriente. Type from gravelly hills, El Cobre, west of Santiago, March 23, 1912 (*Britton, Cowell & Shafer 12874*).

9. PITHECOLOBIUM OBOVALE (A. Rich.) C. Wright; Sauvalle, Anales Acad. Habana 5: 407. 1868

Inga obovalis A. Rich. Ess. Fl. Cub. 1: 472. 1845.
Calliandra revoluta Griseb. Cat. Pl. Cub. 83. 1866.

Leaflets mostly broadly obovate; stamen tube very short; pod flat, curved in a partly complete circle.

Hillsides and river banks. Pinar del Rio and Isle of Pines.

10. **Pithecolobium pinetorum** sp. nov.

A tree up to 10 m. high, the young twigs and leaves puberulent, the old foliage nearly or quite glabrous. Leaves 2 dm. long or less; petioles stout, 1.5–3 cm. long; glands oblong, somewhat elevated; pinnae 1 or 2 pairs; leaflets 3 or 4 pairs, coriaceous, oblong or obovate-oblong, pinnately and loosely reticulate-veined, rounded at the apex, narrowed or obtuse at the base, 3–6 cm. long; peduncles axillary, 3–6 cm. long; calyx coriaceous, campanulate, 5 mm. long, its teeth broadly obovate, rounded, somewhat unequal; corolla pubescent, its tube about 6 mm. long, its lobes 3 mm. long, ovate-lanceolate, acute; stamens 2–2.5 cm. long, united about one-fourth their length; pod curved into a nearly complete circle, about 7 cm. long, 12 mm. wide, flat, not constricted between the seeds; seeds blue and white, shining, orbicular-obovate, 5–6 mm. long.

Mountain pinelands of northern Oriente. Type from southeast of Paso Estancia, May 1–2, 1909 (*Shafer 1725*); fruit and seeds described from *Shafer 3096*, collected in pinelands of Sierra Nipe.

11. **Pithecolobium nipense** sp. nov.

A shrub or a tree up to 10 m. high, the young twigs, petioles and rachises permanently short-pubescent. Leaves 4–6 cm. long; petioles 6 mm. long or less; glands circular, elevated; pinnae 3 or 4 pairs; leaflets 10–16 pairs, oblong, coriaceous, approximate, 2–3 mm. long, 1.5 mm. wide, slightly inequilateral, obtuse at the apex, rounded or subtruncate at base, glabrous, dark green and lustrous above, pale and dull green beneath with the midvein prominent, glabrous or with a few scattered hairs; flowers unknown; pod curved into a partly complete circle, 6–10 cm. long, 7–8 mm. wide, compressed, glabrous, short-stipitate, not constricted between the seeds, or occasionally constricted; seeds blue, shining, oblong-obovate to obovate-orbicular, 6 mm. long.

Mountains of northern Oriente. Type from near Woodfred, Sierra Nipe, 450–550 m. altitude, Dec. 20, 1909 (*Shafer 3220*).

12. PITHECOLOBIUM ASPLENIFOLIUM Griseb. Cat. Pl. Cub. 83. 1866

Western Cuba. Known only from the type collection of *C. Wright 2403*.

13. **Pithecolobium trinitense** sp. nov.

A tree up to 10 m. high; young twigs, petioles and rachises densely brown-puberulent. Leaves 10–15 cm. long; glands circular, 1 mm. in diameter; petioles 1.5 cm. long or less; pinnae 6–8 pairs, approximate; leaflets 12–16 pairs on each pinna, oblong, chartaceous, slightly inequilateral, 5–7 mm. long, 3 mm. wide or less, rounded at the apex, obliquely obtuse at the base, glabrous or nearly so and dark green above, pale, and pubescent beneath, at least on the veins, the midvein prominent; peduncles densely puberulent when young, glabrous when old; young flower-heads densely puberulent; flowers unknown, apparently capitate; pod curved into a nearly complete circle, about 6 cm. long and 7 mm. wide, somewhat constricted between the seeds; seeds blue, shining, orbicular-obovoid, somewhat compressed, 5 mm. long.

Hillside, El Porvenir to Aguacate, Trinidad Mountains, Santa Clara, at 700–900 m. altitude, March 10, 1910 (*Britton & Wilson 5346, type*).

14. **Pithecolobium** (?) **guantanamense** sp. nov.

A tree, 10 m. high with flexuous twigs, the foliage sparingly villous-pubescent. Leaves 6–8 cm. long, petioles slender, 1 cm. long or less; glands scutellate, 0.5 mm. in diameter; pinnae 2 pairs; leaflets 20 pairs or fewer, linear, chartaceous, 5–7 mm. long, 1–1.5 mm. wide, inequilateral, pale green but somewhat darker above than beneath, acute at the apex, obliquely obtuse at the base, the few veins prominent beneath; flowers unknown; pod compressed, glabrous, chartaceous, dehiscent, doubly coiled, 6–8 cm. long, 7–8 mm. broad over the seeds, constricted between them, the coils about 2 cm. broad; immature seeds suborbicular, somewhat flattened, 4 mm. in greatest diameter.

Bank of a water course, United States Naval Station, Guantanamo Bay, Oriente, March, 1909 (*Britton 2051*).

15. PITHECOLOBIUM ARBOREUM (L.) Urban, Symb. Ant. **2**: 259. 1900

Mimosa arborea L. Sp. Pl. 519. 1753.

Pithecolobium filicifolium Benth. in Hook. Lond. Journ. Bot. **3**: 205. 1844.

? *Mimosa filicifolia* Lam. Encycl. **1**: 13. 1783.

Hillsides, river-banks and woodlands at lower and middle elevations, ascending, in Oriente, to at least 330 m.; all provinces

and Isle of Pines; Hispaniola; Porto Rico; Jamaica; Mexico and Central America.

16. PITHECOLOBIUM SAMAN (Jacq.) Benth. Lond. Journ. Bot. 3: 216. 1844

Mimosa Saman Jacq. Fragm. 15. 1809.
Calliandra Saman Griseb. Fl. Br. W. I. 225. 1860.

Hillsides and pastures; all provinces and Isle of Pines: widely distributed in the West Indies. Native of continental tropical America. Not a true *Pithecolobium*. Perhaps referable to *Zygia* [P. Br.] J. St. Hil. Exp. Fam. Nat. 2: 246. 1805. The type of *Zygia*, which has long priority of publication over *Pithecolobium*, is *Z. arborescens* J. St. Hil., which is the same as *Pithecolobium latifolium* (L.) Benth.

17. PITHECOLOBIUM BERTERIANUM (Balbis) Benth. Lond. Journ. Bot. 3: 220. 1844

Acacia Berteriana Balbis; DC. Prodr. 2: 470. 1825.

Hillsides and woodlands in dry districts. Oriente, Camagüey, Santa Clara; Hispaniola; Jamaica.

Not a true *Pithecolobium*.

18. PITHECOLOBIUM TORTUM Mart. Herb. Fl. Bras. 114. 1837

Pithecolobium vincentis Benth. Lond. Journ. Bot. 3: 222. 1844.
Acacia lentiscifolia A. Rich. Ess. Fl. Cub. 469. 1845.

Sand dunes, sandy river-banks, coastal thickets and hillsides near the coast, Santa Clara, Havana, Pinar del Rio, Isle of Pines; St. Vincent; Martinique; Central and South America.

Not a true *Pithecolobium*.

19. PITHECOLOBIUM PREHENSILE (C. Wright) Benth. Trans. Linn. Soc. 30: 593. 1875

Calliandra prehensilis C. Wright; Sauvalle, Anales Acad. Habana 5: 406. 1868.

Rocky river-banks, coastal thickets and saline plains, Oriente; Santa Clara. Endemic.

Perhaps a congener of *P. brevifolium* Benth., the type of the genus *Havardia* Small.

25. FURTHER NOTES ON COMOCLADIA*

1. COMOCLADIA PINNATIFOLIA L. Syst. ed. 10, 861. 1759

Professor Urban has pointed out to me that Linnaeus, who printed the specific name *pinnatif.*, more likely intended this contraction to mean *pinnatifolia* than *pinnatifida*, as I printed it, following the Kew Index.

12. COMOCLADIA PLATYPHYLLA A. Rich.

The species ranges westward in Cuba into the province of Pinar del Rio as far as Corrientes Bay (*Britton & Cowell 9914*).

14. **Comocladia cuneata** nom. nov.

Comocladia acuminata Britton, Bull. Torrey Club 37: 349. 1910. Not *C. acuminata* Moc. & Sessé; DC. Prodr. 2: 65. 1825.

Known hitherto only from the type specimen, this species has recently been collected by Rose, Fitch and Russell (*4185*) at San Pedro de Macoris, Santo Domingo. The broadly cuneate leaf-bases distinguish it from its relatives.

15. COMOCLADIA GLABRA Spreng.

In Flora Portoricensis, Professor Urban refers to this species, the *C. acuminata* Moc. & Sessé, as a variety, and states that it is Porto Rican, rather than Mexican as supposed by DeCandolle.

18. COMOCLADIA DODONAEA (L.) Urban, Symb. Ant. 4: 360. 15 My 1910; Britton, Bull. Torrey Club 37: 351. 29 Jl 1910

The species extends eastward in the Virgin Islands to Tortola (*Britton & Shafer 902*).

26. ANOTHER WEST INDIAN DENDROPANAX

Dendropanax filipes sp. nov.

A slender, straggling shrub up to 3 m. high. Leaves oblong-oblanceolate, thin-coriaceous, 12 cm. long or less, 1–3 cm. wide, rather strongly pinnately veined, acutish at the apex, obtuse or acute at the base, the petioles 2–25 mm. long; peduncle very slender, bracted at the base, apparently nodding, 10 cm. long or

* See Bull. Torrey Club 37: 345–363. 1910.

less; umbel about 12-flowered; pedicels filiform, 8–15 mm. long; flowering calyx only 1.5 mm. high and broad, broadly obconic; petals 1.5–2 mm. long, oblong-lanceolate.

Peckham woods, Upper Clarendon, Jamaica, at about 800 meters elevation, May 22, 1912, *Harris 11057*.

Among the species discussed by me in 1912,* this most nearly resembles the Cuban *D. cuneifolium*.

27. THREE UNDESCRIBED BOURRERIAS†

Bourreria mucronata sp. nov.

A divaricately branched shrub 2 m. high, with very slender branches, the young twigs and branches of the inflorescence appressed-pubescent. Leaves elliptic, 1–3 cm. long, 8–15 mm. wide, coriaceous, acute and mucronate at the apex, narrowed at the base, revolute-margined, reticulate-veined, strongly tuberculate-roughened, shining, and when young hispid above, dull and smooth beneath, the midvein impressed above, prominent beneath, the lateral veins about 5 on each side, the petioles 2–3 mm. long, pubescent when young; inflorescence 3–6-flowered; calyx, in bud, oblong, 3 mm. long, glabrous; corolla unknown; fruiting calyx 3 mm. long, its lobes acutish or obtuse; drupe ovoid-spherical, pointed, 5 mm. long.

Limestone cliff, San Diego de los Baños, Pinar del Rio, Cuba, (*Britton, Earle & Gager 6791*), Sept. 1910. Probably nearest related to *B. setoso-hispida* O. E. Schulz.

Bourreria moaensis sp. nov.

A slender shrub or tree up to 3.3 m. high, glabrous throughout. Leaves obovate or broadly oblanceolate, 10 cm. long or less, 2.5–4.5 cm. wide, coriaceous, revolute-margined, acute or acutish, at the apex, narrowed at the base, the midvein impressed above, prominent beneath, the lateral veins about 6 on each side of the midvein, the petiole stout, only 2–4 mm. long; flowers unknown; fruiting inflorescence stalked, 4 cm. broad or less, 6–8 cm. long, its branches stout; fruiting calyx about 13 mm. long, its ovate acute lobes about as long as the tube; fruit subglobose, 12 mm. in diameter.

Camp La Gloria, south of Sierra Moa, Oriente (*Shafer 8182*), Dec. 24–30, 1910.

* Bull. Torrey Club **39**: 1–14.

† See O. E. Schulz in Urban, Symb. Ant. **7**: 45–71; 349.

Apparently nearest related to *B. grandiflora* (Poir.) Griseb., which has smaller, obtuse leaves with much narrower petioles.

Bourreria Nashii sp. nov.

A shrub, about 1 m. high, the young twigs pilose. Leaves obovate to oblong-obovate, 18 mm. long or less, 4–7 mm. wide, coriaceous, revolute-margined, densely rough-papillose and inconspicuously veined above, canescent, reticulate-veined and the midrib prominent beneath, obtuse, retuse or apiculate at the apex, narrowed at the base, the margin papillose-hispid, the pubescent petiole about 1 mm. long; fruits solitary or 2 together, orange-brown, terminal, subsessile, depressed-globose, about 6 mm. in diameter, persistent calyx-lobes ovate-lanceolate, acute, loosely pubescent.

Foothills, between Marmelade and San Michel, Haiti, Aug. 4, 1905 (*Nash & Taylor 1380*).

Nearest related to the Cuban *B. pauciflora* O. E. Schulz.

28. NOTES ON PSYCHOTRIA*

PSYCHOTRIA LIGUSTRIFOLIA (Northr.) Millsp. Field Col. Mus. **2**: 172. 1906

To the range of this species may now be added BERMUDA, where it is locally abundant, and hitherto referred to *P. undata* Jacq.; FLORIDA: Key Largo (*Curtiss 5501*); CUBA; on coral-rock, Madruga (*Britton & Shafer 776*).

PSYCHOTRIA SULZNERI Small, Fl. Miami 176. 26 Ap 1913

Psychotria pulverulenta Urban, Symb. Ant. **7**: 456. 15 Au 1913.

29. NOTES ON VARIOUS SPECIES

JUNIPERUS LUCAYANA Britton, N. A. Trees 121. 1908

Juniperus australis Pilger, in Urban, Symb. Ant. **7**: 479. 1913.

The types of both are from the Bahamas.

THRINAX MICROCARPA Sargent, Gard. & For. **9**: 162. 1896

Western part of Cayo Cruz, Camagüey, Cuba (*Shafer 2800*). Not heretofore recorded from Cuba:—South Florida; Bahamas.

* See Urban, Symb. Ant. **7**: 433–477.

MAYTENUS PHYLLANTHOIDES Benth. Bot. Sulph. 54. 1844

Cayo Coco, Cayo Sabinal and Cayo Romano, Camagüey, Cuba (*Shafer 1062, 2507, 2633, 2678*). Not heretofore recorded from Cuba:—Southern Florida; Mexico and Lower California.

CROTON NUMMULARIAEFOLIUS A. Rich. in Sagra, Hist. Cub. **11**: 211. 1850

Rocky coastal thicket, Guanica, Porto Rico (*Britton & Shafer 1911*). New to Porto Rico; Cuba.

ACALYPHA ALOPECUROIDEA Jacq. Obs. **3**: 196. 1789

Palo Seco, Porto Rico (*Brother Hioram*, Oct. 1912). New to Porto Rico:—Bahamas, Cuba, Hispaniola, Jamaica, Grenada.

CALLICARPA HITCHCOCKII Millsp. Field Col. Mus. Bot. **2**: 312. 1909

Alto del Aji, Cayo Romano, Camagüey (*Shafer 2791*). Not previously recorded from Cuba:—Bahamas.

CLERODENDRON (?) CALCICOLA Britton, Bull. Torrey Club **39**: 9. 1912

The habitat of this plant, omitted at the place of publication, is limestone rocks, Corrientes Bay, Cuba (*Britton & Cowell 9871*).

LYCIUM CAROLINIANUM Walt. Fl. Car. 84. 1788

Rio Gavelan, Santa Clara (*Britton, Earle & Wilson 6027*) and on Cayo Romano, Camagüey, Cuba (*Shafer 2632*). Not heretofore recorded from Cuba:—Southeastern United States.

STENOSTOMUM MYRTIFOLIUM Griseb. Fl. Br. W. I. 334. 1860

Western part of Cayo Cruz, Camagüey, Cuba (*Shafer 2798*). Not previously reported from Cuba:—Bahamas.

ERNODEA LITTORALIS Sw. Prodr. 29. 1788

In my discussion, in 1908, of the species and races of the genus *Ernodea* Sw. (Bull. Torrey Club **35**: 203–208) I remarked that no species had been found in Cuba, but I can now record the typical race of *E. littoralis* Sw. as occurring between Punta Sol and

Molinas, Nipe Bay, Oriente (*Shafer 1794*), and also on Cayo Romano, Camagüey (*Shafer 2621*).

SPERMACOCE KEYENSE Small, Flora Florida Keys 141. 11 Au 1913

Spermacoce floridana Urban, Symb. Ant. 7: 550. 15 Au 1913.

From the printed dates of publication, Dr. Small has four days priority.

ACANTHOSPERMUM HISPIDUM DC. Prodr. 5: 522. 1836

Island of Culebrita, Porto Rico (*Britton & Wheeler 280*).

30. ASTER IN THE WEST INDIES

Scapose, the scapes monocephalous; leaves rosulate, linear-oblong, pilose. 1. *A. Grisebachii.*

Caulescent, branched, polycephalous.

Rays large, surpassing the involucre.

Leaves, except the basal ones, reduced to small imbricated scales; rootstocks tuberous. 2. *A. adnatus.*

Leaves normal, the upper often small, but distant.

Involucre-bracts densely pubescent, acuminate; inflorescence wand-like; rootstocks tuberous. 3. *A. lucayanus.*

Involucre-bracts glabrous or nearly so, or puberulent; inflorescence paniculate; rootstocks not tuberous.

Not fleshy, or but slightly so, at least the lower leaves flat, linear to spatulate.

Involucre-bracts acuminate, glabrous. 4. *A. bahamensis.*

Involucre-bracts obtuse or merely acutish.

Very densely leafy; involucre-bracts puberulent; rays white. 5. *A. Burgessii.*

Not densely leafy; involucre-bracts glabrous. 6. *A. dumosus.*

Fleshy; leaves all narrowly linear, thick, subterete. 7. *A. Bracei.*

Rays small, little if at all surpassing the involucre.

Stem-leaves lancolate, 6–12 cm. long, 2 cm. wide or less. 8. *A. inconspicuus.*

Stem-leaves linear to linear-oblong.

Stem-leaves elongated-linear; involucre-bracts acuminate. 9. *A. exilis.*

Stem-leaves oblong-linear; involucre-bracts acute. 10. *A. squamatus.*

1. **Aster Grisebachii** Britton, nom. nov.

Haplopappus marginatus Griseb. Cat. Pl. Cub. 149. 1866. Not *Aster marginatus* H.B.K.

Sandy and gravelly pine-lands, Pinar del Rio and Isle of Pines, Cuba.

A species with solitary heads on long, sparingly bracted scapes, the rootstocks much-branched, the rosulate linear-oblong leaves pilose, the rays bright white.

2. ASTER ADNATUS Nutt. Jour. Acad. Nat. Sci. Phila. 7: 82. 1834

Pine-lands, Great Bahama Island; southeastern United States.

3. ASTER LUCAYANUS Britton, Bull. N. Y. Bot. Gard. 4: 143. 1906

Pine-lands, Great Bahama Island.

4. **Aster bahamensis** Britton, sp. nov.

Stout, fibrous-rooted, slightly fleshy, glabrous, 3–20 dm. high. Lower leaves and those of sterile shoots with sheathing petioles 4–7 cm. long, the blades oblong to linear-oblong or oblong-lanceolate, obtuse or acute, 4–8 cm. long, 5–20 mm. wide, sparingly crenate-dentate or entire, narrowed into the petiole, the midvein prominent, the lateral veins obscure; upper stem-leaves linear, entire, 6 cm. long or less, those of the branches nearly subulate, 3–12 mm. long; heads numerous, paniculate; involucre nearly cylindric, 6–8 mm. high, its bracts linear, acuminate, about 0.7 mm. wide, green with scarious margins, or the inner merely green-tipped; rays purple, 4–5 mm. long; achenes columnar, 2.5 mm. long, the angles roughened; pappus brownish, twice as long as the achene.

Moist grounds and marshes, Great Bahama, Andros, Eleuthera and Cat Island. Type from Barnett's Point, Great Bahama (*Britton & Millspaugh 2621*).

5. **Aster Burgessii** Britton, sp. nov.

Rootstock short, thick. Stems clustered or solitary, densely leafy, often with many short branches, pubescent, at least above, 5 dm. high, or less. Lower and basal leaves oblanceolate or spatulate, obtuse or acutish, distantly low-serrate, 2–5 cm. long,

6 mm. wide or less, narrowed into slender, ciliate, partly clasping petioles, otherwise glabrous; stem-leaves similar, but narrower and sessile or nearly so, those of the branches 4–10 mm. long; heads numerous, thyrsoid-corymbose; involucre about 5 mm. high, its bracts in about 4 series, linear, ciliolate or glabrous, obtuse or acutish; rays white, 5–8 mm. long.

Rocky river-banks, Pinar del Rio, Cuba. Type collected on Rio Portales, near Guane, March, 1911 (*Britton, Britton & Cowell 9751*). Erroneously recorded by Grisebach as *Aster carneus* Nees.

6. ASTER DUMOSUS L. Sp. Pl. 873. 1753

Pinelands, high mountains of Santo Domingo; eastern United States.

7. ASTER BRACEI Britton; Small, Fl. Miami 190. 1913

Brackish marshes and savannas, southern Florida, Bahamas, Cuba.

8. ASTER INCONSPICUUS Less. Linnaea 5: 143. 1830

Erigeron expansus Poepp.; Spreng. Syst. 3: 518. 1826. Not *Aster expansus* Nees.

Marshes, ditches and roadsides at lower and middle elevations: Cuba; Jamaica; South Florida; Mexico.

9. ASTER EXILIS Ell. Bot. S. C. & Ga. 2: 344. 1824

Wet grounds, provinces of Santa Clara, Havana and Pinar del Rio, Cuba; Andros Island, Bahamas; southeastern and southern United States.

10. ASTER SQUAMATUS (Spreng.) Hieron. Bot. Jahrb. 29: 19. 1901

Conyza squamata Spreng. Syst. 3: 515. 1826.

Naturalized along roadsides, especially on Ireland Island and Boaz Island, Bermuda. The plant erroneously listed by Lefroy as *Aster Trifolium* L., was probably this species, misprinted for *A. tripolium* L. Native of southern South America.

31. UNDESCRIBED SPECIES OF JAMAICA

Lasiocroton Harrisii sp. nov.

A tree, about 8 m. high, the stout twigs densely brown-tomentose when young, bearing prominent leaf-scars. Leaves oblong-elliptic, rather firm in texture, 8–15 cm. long, 7 cm. wide or less, sharply acuminate at the apex, narrowed at the base, sparingly pubescent above, densely pubescent beneath, yellowish-green, somewhat paler beneath than above, pinnately veined, with about 5 veins on each side of the midvein, the margin entire or slightly undulate, the stout, tomentose petioles 10–16 mm. long; fruiting racemes slender, tomentose, equalling the leaves or longer, the slender tomentose pedicels 10–15 mm. long; fruiting calyx tomentose, 4 mm. broad, the sepals ovate, acute; capsule obtusely 3-lobed, 7 mm. broad, 3–4 mm. high, densely brown-tomentose; styles 2 mm. long; stigmas fimbriate; seeds subglobose, 2.5 mm. in diameter.

Peckham woods, Upper Clarendon, Jamaica, September 9, 1912 (*Harris 11192*).

L. Fawcettii Urban, of Dolphin Head Mountain, Jamaica, differs in having nearly glabrous long-petioled leaves.

Varronia clarendonensis sp. nov.

A slender shrub with weak straggling branches, the twigs loosely pilose. Leaves broadly ovate-elliptic, 5–10 cm. long, 3–7 cm. wide, firm-chartaceous in texture, rather strongly pinnately veined, coarsely and sharply dentate, obtuse at the apex, obtuse or subtruncate at the base, loosely pilose beneath scabrous-pubescent and papillose above, the loosely villous petioles 1.5 cm. long or less; peduncles slender, pilose, 5–8 cm. long; heads globose, densely many-flowered, 2 cm. in diameter; calyx brown-pilose above, its tube about 4 mm. long, its lobes triangular-ovate with linear, pilose, curled tips 5–6 mm. long; corolla about 9 mm. long, its lobes short and broad; stamens about equalling the corolla; filaments filiform; anthers oblong.

Peckham woods, Upper Clarendon, Jamaica, July 7, 1911 (*Harris 10995*).

Jacobinia (?) **jamaicensis** sp. nov.

Stem stout, 3–6 dm. high, densely long-villous. Leaves lanceolate to ovate-lanceolate, 6–10 cm. long, 1.5–3 cm. wide, rather firm in texture, densely villous-pubescent on both sides, acuminate at the apex, narrowed to an obtuse base, with villous

petioles 2–4 mm. long; spike terminal, few-flowered; bracts lanceolate, acuminate, villous, about 1.5 cm. long; calyx-teeth narrowly lanceolate, loosely villous; corolla rose-colored, 3.5 cm. long, loosely villous, 2-lipped, the teeth of the lobes short and rounded; filaments slender, nearly as long as the corolla, glabrous; anthers 2.5 mm. long.

Crevices of limestone rocks, Peckham woods, Upper Clarendon, Jamaica (*Harris 10978, type; 11178*).

32. UNDESCRIBED CUBAN SPECIES

Copernicia rigida Britton & Wilson, sp. nov.

A tree up to 6 m. high, with a slender cylindric trunk. Leaf-blades wedge-shape, 13–15 dm. long, deeply grooved below the middle, bright green above, paler beneath and sometimes armed on the margins of the grooves with small, straight or recurved teeth 1–4 mm. long; leaf margins armed mostly below the middle with numerous recurved, straight, ascending, or sometimes hooked teeth 3–7 mm. long; petiole short, stout, 1–1.5 dm. long, 1–1.4 dm. broad, unarmed; ligule rigid, rhombic-ovate, 2.5–3.5 dm. long, 1.7–2 dm. broad, armed on the margin with ascending, recurved, straight or sometimes hooked teeth 3–12 mm. long, coalescent with and decurrent on the short petiole; inflorescence lax, branches slender, the ultimate ones densely clothed with short hairs; spathes of the inflorescence abruptly tapering to a long, slender acuminate tip; flowers unknown; fruit subglobose, 1.5–1.6 mm. long, 1.4–1.6 mm. broad, brown, shining; old calyx persistent beneath the fruit, the lobes triangular; seed subglobose, 9–11 mm. long.

Type collected in the vicinity of Tiffin, Camagüey, Cuba, November 1–5, 1909 (*Shafer 2895*); also collected at Santa Lucea, Camagüey (*Shafer 971*); Province of Santa Clara (*Britton & Wilson 4563; Britton, Cowell & Earle 10299*).

Copernicia Cowellii Britton & Wilson, sp. nov.

A small tree, up to 3 m. high, the head globose, about 1 m. in diameter, very dense, the trunk up to 1.7 dm. thick, strictly cylindric. Leaves many, the blades shining, yellow-green above, covered with a bright white waxy bloom beneath, about 6 dm. long, somewhat wider than long, the younger erect, the older persistent, reflexed; petioles white-waxy, 1 dm. long or less, 3–5 cm. wide, flattened, armed with irregular, curved and somewhat hooked teeth 5–8 mm. long; margins of the leaves with many

recurved teeth 2–3 mm. long, the leaf otherwise unarmed; inflorescence lax, the branches slender, densely clothed with short hairs; spathes of the inflorescence gradually tapering to long acuminate tips; calyx cylindric, 3–3.5 mm. high, the lobes strongly mucronate; corolla 5–6 mm. long, densely clothed with short, mostly appressed hairs on the outer surface, the lobes prominently grooved within below the middle, the grooves hairy on the margin, longitudinally converging and bearded above; dilated portion of the filaments prominently triangular; carpels truncate at the summit, grooved; styles nearly cylindric; fruiting panicles about twice as long as the leaves, pendent, glabrous, much-branched, slender, the stalk about as long as the fruit-bearing part; sheath closely appressed, the lower up to 1 dm. long; fruits close together on the ultimate branches of the panicle, subglobose, obovoid, a little longer than thick, yellow when full-grown but not quite ripe, shining, 14–17 mm. long; old calyx-segments persistent under the fruit, triangular-ovate, acute, 2 mm. long; flesh of old ripe fruit very thin; seed smooth, about 12 mm. long; endosperm bony, grooved.

Seedlings have rough-edged leaves green on both sides.

Type collected in savannas near Camagüey, Cuba, April 2–7, 1912 (*Britton, Britton & Cowell 13187*); also collected in the province of Camagüey (*Shafer 508, 1144, 2917*).

Anneslia enervis sp. nov.

A shrub or small tree 4 m. high, with slender, stiff, somewhat zigzag twigs sparingly pubescent when young, soon glabrous. Leaves very small; pinnae 2, the petiole and petiolules each about 1 mm. long, rather stout; pinnules 2 to each pinna, 2–3 mm. long, obovate, sessile, nerveless, shining, rounded at the apex, oblique at the base; heads nearly sessile in the upper axils, few-flowered; calyx campanulate, 1.5 mm. long, its teeth acute; corolla about 3 mm. long; stamens 6–7 mm. long; legume glabrous, 3–4 cm. long, 5 mm. wide, abruptly tipped at the apex, narrowed from below the middle to the base, the valves subcoriaceous.

Mountains of northern Oriente, Cuba; type from Camp La Gloria, south of Sierra Moa, *Shafer 8274*, December, 1910.

Not closely related to any species known to me, but somewhat resembling **A. colletioides** (Griseb.) Britton [*Calliandra colletioides* Griseb.] of low elevations in dry parts of the same province.

Belairia parvifoliola sp. nov.

A slender tree, up to 10 m. high, the twigs copiously armed with dark brown to black subulate spines 1.5–3 cm. long. Leaves short-petioled, the slender rachis puberulent or short-pubescent; leaflets 7–13, oblong to oblong-lanceolate, shining, nearly equally bright green and rather prominently veined on both sides, 8–13 mm. long, 2–3 mm. wide, the base inequilateral, the apex mucronate, the petiolules 0.5 mm. long; legume narrowly oblong, 10–12 mm. long, 3–4.5 mm. wide, narrowed at base and apex, strongly veined, borne on a filiform pedicel 6 mm. long or more.

Coastal woods, thickets and hillsides, southern Oriente, from Guantanamo Bay to Ensenada de Mora. Type, *Britton, Cowell & Shafer 13037*, Ensenada de Mora, March, 1912.

Meibomia Cowellii sp. nov.

Root thick and woody; stem slender, stiff, erect, hirsute, 3–8 dm. high, simple, or with few nearly erect hirsute branches. Leaves unifoliolate, short-petioled, oblong, linear-oblong or lanceolate, subcoriaceous, 2–10 cm. long, 2.5 cm. wide or less, obtuse and mucronulate at the apex, obtuse at the base, rather strongly reticulate-veined, finely short-pubescent above, villous-pubescent on the veins beneath, nearly equally green on both sides, the rather stout petioles 2–10 mm. long, the stipules lanceolate, striate, acuminate, 2–4 mm. long, the stipels subulate, about 3 mm. long; panicle narrow, nearly simple, long-stalked, 1–3 dm. long; bracts linear-subulate, 2.5–4 mm. long; pedicels filiform, puberulent, 4–7 mm. long; calyx 2.5–3 mm. long, campanulate, pubescent, lobed to about the middle, the lobes lanceolate, acute; corolla purple, 10 mm. broad; loment short-stipitate, 4–6-jointed, 2 cm. long or less, nearly equally constricted on both margins, the joints oval, about 4 mm. long and 2.5 mm. broad, loosely pubescent, indistinctly reticulate-veined.

Savannas and pine-lands, Pinar del Rio and Isle of Pines, Cuba. Type, *Britton, Britton & Cowell 10090*, from between Pinar del Rio and Coloma, March 16, 1911. Related to *M. angustifolia* (H.B.K.) Kuntze.

Kieseria cubensis sp. nov.

A tree, up to 13 m. high, the twigs stout, densely leafy toward the ends. Leaves coriaceous, oblong-obovate, 6–10 cm. long, 3 cm. wide or less, obtuse and rounded or somewhat emarginate at the apex, narrowed to the nearly sessile base; midvein impressed

above, rather prominent beneath, the lateral veins obscure; peduncles solitary in the upper axils, stout, ancipital, 3–5 cm. long, 2-bracted at the top; bracts oblong, obtuse, about 1 cm. long; fruiting pedicels stout, subterete, 1–2.5 cm. long; sepals narrowly oblong, obtuse, 1.5 cm. long, entire; capsule about as long as the sepals, tapering into a stout-subulate beak about 6 mm. long.

Mountains of northern Oriente, Cuba. Type, *Shafer 8121*, from Camp La Gloria, south of Sierra Moa, December 1910. The genus is hitherto known only from South America. The Cuban species most resembles *Bonnetia anceps* Mart., of Brazil. The generic name *Kieseria* Nees, has priority over *Bonnetia* Mart., which is a homonym of *Bonnetia* Schreb.

33. A HYBRID PALM

On the sterile "savannas" north and east of Camagüey, Cuba, palms of two species of *Copernicia* abound. The one, *C. hospita*, has grey-green, thin foliage with spiny-toothed petioles about as long as the blades, and elongated, slender panicles; the other, *C. macroglossa*, has bright green, rigid foliage with very short, broad, unarmed petioles, the blades spiny-toothed on the margins of the outermost segments and on the upper surface of the ribs of the undivided part, the stout panicles not much longer than the leaves and the inflorescence with large bracts.

Of the two, *C. hospita* is the more abundant, *C. macroglossa* growing in colonies, more or less surrounded by it. At many places where the two grow together, plants intermediate in foliage characters occur, their leaves with spiny-toothed petioles of various lengths, the blades with sparingly spiny-toothed margins, otherwise smooth, and in color varying from green to grey, the panicles short and the inflorescence lacking the characteristic large bracts of *C. macroglossa*.

Field observations during four days with Mr. John F. Cowell, led us to the conclusion that these intermediate plants are of hybrid origin rather than a third species, as was first suggested.

34. PORTLANDIA [P. BR.] L., IN THE WEST INDIES

The type species is *Portlandia grandiflora* L.

1. Leaves cordate or subcordate at base, sessile or nearly so.
   Capsules 1 cm. long or less.
      Leaves orbicular, 2.5 cm. wide or less; corolla yellow; flowers sessile or very nearly so. — 1. *P. sessilifolia.*
      Leaves elliptic, 5–10 cm. long; corolla pinkish; flowers pedicelled. — 2. *P. nitens.*
   Capsules nearly 2 cm. long. — 3. *P. Harrisii.*
2. Leaves narrowed or rounded at the base, petioled.
   Leaves rounded or obtuse at the apex.
      Leaves elliptic. — 4. *P. elliptica.*
      Leaves obovate or oblanceolate.
         Capsule involucrate by bractlets. — 5. *P. involucrata.*
         Capsule not involucrate. — 6. *P. uliginosa.*
   Leaves acute or acuminate at the apex.
      Calyx-lobes oblong to ovate. — 7. *P. grandiflora.*
      Calyx-lobes linear to subulate.
         Capsule 1 cm. long or less; leaves 5–8 cm. long. — 8. *P. pendula.*
         Capsule 1.5–5 cm. long; leaves 6–15 cm. long.
            Capsule scarcely angled.
               Leaves ovate to elliptic; calyx-lobes linear; corolla 5–7 cm. long. — 9. *P. coccinea.*
               Leaves oblong-lanceolate; calyx-lobes long-subulate; corolla 2–2.5 dm. long. — 10. *P. Lindeniana.*
            Capsule distinctly angular.
               Capsule long-stalked, truncate. — 11. *P. daphnoides.*
               Capsule short-stalked, narrowed at both ends. — 12. *P. domingensis.*

1. **Portlandia sessilifolia** sp. nov.

A branching resinous shrub about 1.3 m. high, the young twigs short-pubescent, angular. Leaves thick-coriaceous, orbicular, 1.5–3 cm. long, sessile, subcordate, shining above, dull beneath, very indistinctly veined, the margins thick and revolute, their bases connected by a stipular sheath; inflorescence terminal, sessile, subcapitate, several-flowered; pedicels very short; calyx about 8 mm. long, very resinous, the linear lobes about as long as the tube; corolla tubular-campanulate, yellow, 1.5 cm. long; capsule oblong-obovoid, 5–6 mm. long.

Wet mountains of northern Oriente, Cuba. Type from Camp La Gloria, south of Sierra Moa, Cuba, December, 1910 (*Shafer 8190*).

A specimen from between Rio Yamaniguey and Camp Toa (*Shafer 4180*) with much larger elliptic leaves, 11 cm. long or less, but otherwise similar, may, perhaps, be referred to this species.

2. PORTLANDIA NITENS Britton, Bull. Torrey Club 39: 10. 1912
Wet mountains of northern Oriente, Cuba.

3. PORTLANDIA HARRISII Britton, Bull. Torrey Club 39: 8. 1912
On limestone rocks, Peckham Woods, Upper Clarendon, Jamaica.

To the original description the following may now be added from Mr. Harris' subsequent collections and observations: Corolla white, tinged with rose, urn-shaped, about 9 cm. long and 3.5 cm. wide at the mouth, fragrant, the tips of its lobes reflexed; pedicels and calyx-lobes usually claret-colored; calyx-lobes oblong, about 1.5 cm. long and 5 mm. wide; filaments pubescent below; anthers narrowly linear, yellow, nearly 2 cm. long, about half as long as the filaments (*Harris 11209*, Sept. 28, 1912).

4. **Portlandia elliptica** sp. nov.

A slender shrub 3.3 m. high, the young twigs, pedicels and calyx finely pubescent. Leaves elliptic, coriaceous, glabrous, or when young, slightly pubescent, 8 cm. long or less, 2–4 cm. wide, obtuse or rounded at the apex, narrowed at the base, dark green and shining above, bright green and rather dull beneath, the midvein prominent, the lateral veins obscure, the stout petioles 1 cm. long or less, the stipular sheath truncate; inflorescence terminal, sessile, few-flowered; pedicels slender, 5–8 mm. long; calyx 10–12 mm. long, its linear-lanceolate lobes longer than the tube; corolla narrowly campanulate, glabrous, ochroleucous, 2 cm. long; capsule obovoid, 12 mm. long.

Thickets on serpentine rocks, between Baracoa and Florida, Oriente, Cuba, March 15, 1910 (*Shafer 4332*).

5. PORTLANDIA INVOLUCRATA Wernham, Jour. Bot. 51: 320. 1913
Wet parts of northern Oriente, Cuba. As remarked by Mr. Wernham, perhaps not of this genus; the corolla is unknown.

6. PORTLANDIA ULIGINOSA Wernham, Jour. Bot. 51: 320. 1913
Between Rio Yamaniguey and Camp Toa, northern Oriente, Cuba.

7. PORTLANDIA GRANDIFLORA L. Syst. ed. 10. 928. 1759
Thickets and hillsides at lower and middle altitudes, in moist districts, Jamaica; St. Thomas (native?); cultivated in Grenada, and in St. Croix.

8. PORTLANDIA PENDULA C. Wright; Griseb. Cat. Pl. Cub. 126. 1866

Pendent on limestone cliffs, Pinar del Rio, Cuba.

A beautiful species, the pendent habit unusual, the branches sometimes drooping to a length of 2 meters or more; the flowers are fragrant.

9. PORTLANDIA COCCINEA Sw. Fl. Ind. Occ. 1: 384. 1797

P. coriacea Sw.; Spreng. Syst. 1: 708. 1825.

Thickets and hillsides at lower elevations in dry districts, southern side of Jamaica.

10. **Portlandia Lindeniana** (A. Rich.) Britton, nom. nov.

Gonianthes Lindeniana A. Rich. in Sagra, Hist. Cub. 11: 10. *pl. 49 bis.* 1850.

Portlandia gypsophila Macf. Fl. Jam. 2: 216; Griseb. Fl. Br. W. I. 324. 1861.

A tree, up to 8 meters high. Leaves chartaceous, oblong-lanceolate, pinnately veined, sharply acuminate at the apex, narrowed at the base, 12–20 cm. long, the petioles about 8 mm. long; flowers solitary in the axils; peduncles about 2 cm. long; calyx-teeth narrowly linear, 2.5–3.5 cm. long; corolla white, 2–2.5 dm. long, the narrowly campanulate limb much longer than the nearly cylindric tube; capsule oblong-obovoid, 4–5 cm. long, 15–18 mm. thick, smooth, not angled.

Wooded river and stream-banks at lower elevations, province of Oriente, Cuba; Jamaica? Cultivated in Martinique.

11. PORTLANDIA DAPHNOIDES R. Graham, Edinb. N. Phil. Jour. 1840–41: 206

Gonianthes Sagraeana A. Rich. in Sagra, Hist. Cub. 11: 11. 1850.

Portlandia longiflora Meisn.; Griseb. Cat. Pl. Cub. 126. 1866.

A shrub, about 1.3 meters high. Leaves thin, oblong, narrowed at both ends, rather dull green, pinnately veined, 7–13 cm. long, the petioles 1 cm. long or less; flowers solitary in the axils; peduncles 1–3 cm. long; calyx-lobes linear, 1.5–2 cm. long; corolla yellowish, about 2 dm. long, the campanulate limb about as long as the slender tube; capsule obpyriform, angled, truncate, 2.5–3 cm. long, slender-peduncled.

On rocks, especially along rivers and brooks, at lower and middle elevations, provinces of Oriente, Matanzas, and Pinar del Rio, Cuba.

The use of the name *P. daphnoides* for this species is taken from Graham's description, which does not agree with our specimens in all respects. I have not seen the type specimen. The shrub is abundant in the limestone hills of Pinar del Rio.

12. **Portlandia domingensis** sp. nov.

Foliage similar to that of the preceding species, but the petioles shorter, about 2 mm. long; flowers unknown; capsules short-peduncled, oblong, 5-angled, apparently somewhat fleshy, 4–4.5 cm. long, narrowed at both ends; calyx lobes linear, somewhat broadened at the base, about 1.5 cm. long.

Near San Pedro de Macoris, Santo Domingo, March 26, 1913 (*Rose, Fitch & Russell 4176*).

Observations on the behavior of some species at the edges of their ranges*

ROBERT F. GRIGGS

Various writers on ecology and plant geography have spoken of the behavior of species at the edges of their ranges—of the habitats they affect, of their reproduction, and of their abundance. These statements are of course based on impressions from the experience of the authors, but there are few extensive records of detailed observations on these matters. It is clear that a knowledge of the causes which set the limits to the distribution of species is of fundamental importance to the student of plant geography and it is obvious that the termini of the ranges are the only localities favorable to the study of these conditions. But an understanding of the matter can be reached only after the collection of a large amount of detailed evidence from numerous regions. It is with the desire of contributing one detail toward such a body of evidence that the present observations are published.

The area in which these observations were made is unusually favorable for such studies since a large proportion of the native flora here reaches its territorial limits. 122 species, about 13 per cent. of the native flora, reach, so far as is now known, the limits of their ranges in one direction or another, in the Sugar Grove region. This is a narrow strip of country covering the area of maximum outcrop of a heavy sandstone, the Black Hand Conglomerate, stretching from the edge of the terminal moraine a few miles north of the town of Sugar Grove in Fairfield County, Ohio, southward to the valley of Queer Creek, east of South Bloomingville, in Hocking County. The high cliffs and narrow ravines formed in the weathering of this sandstone impart a ruggedness to the country which is largely responsible for its botanical interest, providing suitable habitats for many of its rare plants and at the same time rendering the land unsuitable for agricultural purposes,

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thus in a measure insuring their preservation. It is for this reason wilder and more nearly in its aboriginal condition than the less rugged country which surrounds it. Since the time of Sullivant

FIG. 1. *Sullivantia*, south of Sugar Grove

it has been known to the botanists of Ohio as one of the richest collecting grounds in the state. The flora of the northern portion, that lying in Fairfield County, was worked up more than seventy

years ago by John M. Bigelow, an able botanist, thus affording an exceedingly interesting basis for comparison of present with past conditions.

Although the Sugar Grove area lies at the end of the long lobe of the Alleghenian Floral Area which Merriam's* map shows stretching into northeastern Ohio, the plants which terminate here are by no means all Alleghenian but include species of varied geographical affinity stretching away from the area in all directions as was shown in a preceding paper.†

It must be pointed out at the outset that the list of plants here given as reaching their territorial limits is by no means a complete or final catalogue. From the nature of the case it will be subject to a considerable amount of revision as the flora of the country becomes better known. When the manifold sources of error which enter into the study are taken into consideration the results might almost be said to have been reached by the multiplication of uncertainties. Nevertheless it is believed that present knowledge is sufficient to justify their publication for, however much the status of individual species may be changed by later discoveries, it does not seem likely that the general outlines of the account here presented will require much readjustment. The first source of error lies in the fact that as the flora becomes better known plants which are not now known beyond the borders of this area may be found in adjoining counties, thereby being removed from the list. In view of the fact that the Sugar Grove area has been more thoroughly worked than the surrounding territory the number of these may be somewhat large. Plants new to the area may be discovered and added to the list. But probably more important than changes due to either of the above causes will be the addition of numerous species, now reported from the region, whose ranges are not yet known with sufficient accuracy to enable us to tell whether they here reach their limits or not. In this category are many groups of plants which have not been collected thoroughly enough in Ohio to justify any deductions as to their distribution. Many groups are so difficult of identification that only the deter-

* Merriam, C. Hart. Life zones and crop zones of the United States. U. S. Dept. Agr. Biol. Survey Bull. 10. 1898.

† Griggs, Robert F. Observations on the geographical composition of the Sugar Grove Flora. Bull. Torrey Club 40: 487–499. *f. 1–10.* 10 S 1913.

minations of the specialist are dependable. These must be eliminated from consideration by plant geographers because no reliance can be placed on the various local lists which must form, in large measure, the basis of such work. Lastly there is a very large and at present increasing number of plants, the very specific identity of which is not yet understood. These include numerous recently recognized species and some older ones which have not been sufficiently studied. The difficulties occasioned by these deficiencies in our knowledge have limited the work very considerably and because of them I have sought to illustrate my points as far as possible with such well-known and conspicuous species as *Kalmia latifolia* and *Rhododendron maximum*, which are collected and listed by every amateur botanist.

The first question that arises concerning the behavior of a species at the edge of its range is as to its abundance. Do the individual plants become scarcer and scarcer until finally the species fails altogether, or is it common close up to the edge where it suddenly stops short? The species whose ranges terminate in the Sugar Grove area are therefore classified from this point of view in the following table.

ABUNDANCE OF SPECIES ON THE EDGES OF THEIR RANGES

Plants common in many stations

Andropogon virginicus
*Aralia spinosa**
Aruncus Aruncus
Ascyron hypericoides
Asplenium pinnatifidum
Aster divaricatus
*Betula lutea**
*Betula nigra**
Carex costellata
Cassia nictitans
Castanea dentata
Chimaphila maculata
Chrysosplenium americanum
*Circaea alpina**
Cornus stolonifera (abundant at Columbus at least)
Cunilla originoides
Cypripedium acaule
Dasystoma laevigata
*Dentaria heterophylla**
Diospyros virginiana
Epigaea repens
*Eupatorium aromaticum**
Eupatorium coelestinum
*Eupatorium rotundifolium**
Fraxinus quadrangulata†
Gaultheria procumbens
Hieracium paniculatum
Hieracium venosum
Hydrangea arborescens
Isopyrum biternatum†
Juncoides saltuensis
Kalmia latifolia
Koellia incana
Lechea racemulosa
Lycopodium lucidulum
Lycopodium lucidulum porophilum
Lysimachia quadrifolia
Oxydendrum arboreum
Panicum polyanthes

Pinus rigida
Pinus virginiana
Pyrola elliptica
Quercus Prinus
Rhododendron maximum‡
Rubus odoratus
Salix amygdaloides†
Sambucus pubens
Saxifraga virginiensis
Sericocarpus asteroides
Stachys cordata
*Silene rotundifolia**
Solidago juncea
*Sullivantia Sullivantii**
Trichostema dichotomum
Tsuga canadensis
Unifolium canadense
Viola hirsutula
Viola rostrata

Common in few stations

Asplenium montanum
Azalea lutea‡
*Iris cristata**
Lobelia puberula
Pedicularis lanceolata
Phacelia dubia‡
Phlox stolonifera
Quamasia hyacinthina§
*Viola rotundifolia**

Individuals abundant in one station

Dodocatheon Meadia§ ¶
*Hypericum Drummondii**
*Melampyrum lineare**
Saxifraga pennsylvanica‡ (probably in other stations as well).

Rather common

Achroanthes unifolia
Aster macrophyllus
Anemone canadensis
Aristida dichotoma
Capnoides sempervirens
*Chrysopsis mariana**
Isotria verticillata
Lobelia leptostachys
Populus tremuloides
Porteranthus stipulatus
*Quercus minor**

Scarce

Aesculus octandra‡
Aronia nigra
*Blephariglottis peramoena**
*Lycopodium complanatum**
Lycopodium obscurum
Passiflora lutea
Pyrola rotundifolia
Scutellaria galericulata
Smilax echirrata
Valeriana pauciflora§
Viburnum dentatum
Viburnum molle.

Individual plants rare and widely scattered

Afzelia macrophylla
Asclepias Sullivantii
Asclepias variegata
Blephariglottis lacera
Fraxinus nigra||
Gentiana crinita
Gymnocladus dioica§ || **
Lycopodium clavatum
Napaea dioica
Parnassia caroliniana
Psoralea Onobrychis
Stylosanthes biflora

---

* Species confined to the southern portion of the area.
† Species reaching their limits immediately to the west of the area.
‡ Species confined to the northern portion of the area.
§ Main body of range ends in Central Ohio but extends locally into Pennsylvania.
¶ Also reported from another station by Bigelow.
|| Not known south of Columbus.
** Fairly common a few miles to the westward.

Frequency of occurrence not observed

Bidens aristosa	*Panicularia elongata*
Eatonia nitida	*Rynchospora glomerata*
Panicum stipitatum	*Solidago erecta*

Plants reported by Bigelow but not now known in the area*

Brauneria purpurea.§	*Panicularia acutiflora*
Cardamine rotundifolia	*Panicularia pallida*
Carduus virginicus	*Trifolium reflexum*
Cypripedium Reginae	*Trollius laxus*
Dasyphora fruticosa	*Veratrum Woodii*
Lysias orbiculata	

SUMMARY

Common in many stations	58
Common in few stations	9
Individuals abundant in one station	4
Rather common	11
Scarce	12
Rare	12
Frequency of occurrence not observed	6
Not now known from the area	11
Total	123

It is clear from these lists that in this region the species in which the individuals become scarcer and scarcer until it fails altogether is exceptional. In the majority the individuals are abundant in their respective stations up to the very edge of their ranges.

But one who studies the ranges of species in a broad way rather than in a restricted area, gets a decided impression that the ranges of most species are bordered by a fringe of outlying stations at considerable distances from each other. Many of the most interesting species of the Sugar Grove region are such outliers. Those which are not known elsewhere within approximately one hundred miles are listed below. It may be asserted with some confidence that some of these such as the *Rhododendron* and the *Azalea* really do not occur elsewhere within the boundaries of the state of Ohio, but some of the others have not yet been searched for enough to justify much confidence in their assignment to this category. One of the list, *Silene rotundifolia*, occurs in Jackson County only twenty-five miles south of our area but as its next known station is far beyond the borders of the state, it seems only

* Florula Lancastriensis. Proc. Medical Convention of Ohio 1841: 49–79. Columbus, 1842.

proper to include it here. Numerous other species must be outliers separated from their nearest stations by smaller intervals, but the distribution of the Ohio flora is not yet well enough known to

FIG. 2. *Blephariglottis peramoena* in flower at Sugar Grove. Plant unusually strong, with unusually large flower clusters.

enable us to pick out these species with sufficient accuracy to justify the attempt. The list of outliers separated by the larger interval includes:

SPECIES	NEXT KNOWN STATION
Achroanthes unifolia	Only Ohio Station.
Aralia spinosa	Clermont Co.
Asclepias Sullivantii	Erie Co.
Asclepias variegata	Summit Co.
Asplenium montanum	Summit Co.
Azalea lutea	Only Ohio Station.
Betula lutea	Wayne Co.
Circaea alpina	Clarke Co. (75 miles) and Summit Co.
Cypripedium acaule	Said formerly to have occurred in Licking Co. immediately to the north.* Nearest station known to me, Medina Co.
Dodecatheon Meadia	Clarke Co. (75 miles).
Eupatorium aromaticum	Only Ohio Station.
Eupatorium rotundifolia	Only Ohio Station.
Hypericum Drummondii	Clermont and Ashtabula Counties.
Lycopodum clavatum	Geauga Co.
Juncoides saltuensis	Mahoning Co.
Melampyrum lineare	Lorain Co.
Phacelia dubia	Only Ohio Station.
Phlox stolonifera	Only Ohio Station.
Pyrola rotundifolia	Summit Co.
Polygonum arifolium	Wayne Co.
Rhododendron maximum	Only Ohio Station.
Silene rotundifolia	Hocking and Jackson Counties only.
Sullivantia Sullivantii	Highland Co.
Viola hirsutula	Only Ohio Station yet known.
Viola rotundifolia	Cuyahoga Co.

There are on the other hand many species which are abundant all along the edges of their ranges. The plants in this category contrast strongly with the outliers, which are plants of diverse geographical affinity, in that they belong for the most part to two definite groups: Alleghenian plants here on the western edges of their ranges, and southern plants limited to the poor soils of the uplands. Some of them, such as *Pinus rigida*, are to be found within a few miles almost anywhere that one may choose to enter their ranges, even though the individuals may be somewhat scarce at the very edge. In some of the others the case is not so clear from collections at present available, but all those here included are known from at least three contiguous counties in our region. They are moreover plants which field experience leads me to

* Jones, H. L. Flora of Licking Co. Bull. Sci. Lab. Dennison University 7: 85. 1892.

FIG. 3. A small plant of *Epigaea repens* in flower at Sugar Grove

suppose common over much wider areas than is shown by the collections. This list includes:

Andropogon virginicus
Asplenium pinnatifidum
Aster divaricatis
Aruncus Aruncus
Ascyron multicaule
Betula nigra
Castanea dentata
Chimaphila maculata
Cunilla originoides
Daystoma laevigata
Epigaea repens
Eupatorium coelestinum
Gaultheria procumbens
Gyrostachys gracilis
Hieracium venosum
Kalmia latifolia
Lycopodium lucidulum
Lycopodium complanatum
Oxydendrum arboreum
Pinus rigida
Pinus virginiana
Pyrola elliptica
Quercus Prinus
Saxifraga virginiensis
Sericocarpus asteroides
Solidago bicolor
Tsuga canadensis

If now we attempt to determine by analysis the factors which cause the termination of the ranges, our first inquiry is naturally concerning the reproductive functions of the plants under discussion. It has been supposed, somewhat generally, that the reproductive functions of many species fail at the northern or southern edges of their ranges. The failure may occur at any one of several points in the cycle: a plant may not produce flowers in sufficient numbers to maintain its place in plant society; it may

flower freely but fruit sparingly either because of faulty fertilization or because of a short season; conditions while adequate for adult plants may be unfavorable for the development of seedlings. To determine how far these various possibilities restrict the spread of the plants under consideration they have been classified according to the apparent success of the reproductive system as follows:

FIG. 4. *Unifolium canadense* at Sugar Grove. Beds as thick as this are rare in this region. Although flowering freely, the plant does not fruit well

REPRODUCTION OF SPECIES ON THE EDGES OF THEIR RANGES

Flowering scantily

*Gaultheria procumbens**	*Pyrola elliptica**
Isotria verticillata	*Pyrola rotundifolia**
Passiflora lutea	*Sambucus pubens*†*
Phlox stolonifera†*	*Stylosanthes biflora*

Fruiting sparingly although flowering freely

Aesculus octandra‡*	*Lysimachia quadrifolia*
Asclepias variegata	*Napaea dioica*¶*
Blephariglottis lacera	*Quercus minor*
Diospyros virginiana	*Rubus odoratus.*
Lycopodium lucidulum porophilum§*	*Unifolium canadense*

* Fruit appears to "set" and mature well.

† Species confined to the southern portion of the area.

‡ Species confined to the northern portion of the area.

§ Sporangia comparatively scarce.

¶ Dioecious, only one plant found.

Flowering freely, fruiting not observed

Achroanthes unifolia
Anemone canadensis
Aronia nigra
Aster macrophyllus
Bidens aristosa
Blephariglottis peramoena†
Chrysopsis mariana†
Chrysosplenium americanum
Dentaria heterophylla‡
Eatonia nitida
Epigaea repens
Hypericum Drummondii† ||
Isopyrum biternatum¶
Iris cristata†
Polygonum arifolium†
Quamasia hyacinthina¶
Scutellaria galericulata
Solidago erecta
Solidago juncea
Stachys cordata
Trichostema dichotomum
Valeriana pauciflora§

Fruiting freely

Afzelia macrophylla
Andropogon virginicus
Aruncus Aruncus
Ascyron multicaule
Azalea lutea
Capnoides sempervirens
Carex costellata
Castanea dentata
Cunilla originoides
Cypripedium acaule°
Dasystoma laevigata
Epigaea repens
Dodecatheon Meadia† **
Eupatorium aromaticum†
Eupatorium coelestinum
Eupatorium rotundifolium†
Hieracium paniculatum
Hydrangea arborescens
Koellia incana
Juncoides saltuensis
Lobelia puberula†
Lycopodium lucidulum††
Lycopodium clavatum † ††
Lycopodium complanatum † ††
Lycopodium obscurum† ††
Panicum polyanthes
Panicum stipitatum
Pedicularis lanceolata
Phacelia dubia‡
Porteranthus stipulatus
Salix amygdaloides¶
Sericocarpus asteroides
Viola hirsutula
Viola rotundifolia†
Viola rostrata

Fruiting freely, seedlings also abundant

Aralia spinosa†
Aster divaricatus
Betula lutea†
Betula nigra†
Cassia nictitans
Circaea alpina†
Gymnocladus dioica§ ¶
Hieracium venosum
Kalmia latifolia
Melampyrum lineare†
Oxydendrum arboreum
Pinus rigida
Pinus virginiana
Quercus Prinus
Rhododendron maximum
Saxifraga pennsylvanica‡
Saxifraga virginiensis
Silene rotundifolia†
Sullivantia Sullivantii†
Tsuga canadensis

|| Not maintaining itself, perhaps only a waif.
¶ Species reaching their limits immediately to the west of the area.
° Many flowers are unfertilized but fruit is common.
** Also reported from another station by Bigelow.
†† Sporangia abundant.

Pteridophytes, prothallia not observed

Asplenium montanum
Asplenium pinnatifidum
Lycopodium clavatum†
Lycopodium complanatum†
Lycopodium lucidulum
Lycopodium lucidulum porophilum
Lycopodium obscurum

Species abundant by vegetative propagation (scattered through above groups)

Cypripedium acaule
Gaultheria procumbens
Iris cristata
Lycopodium lucidulum
Lycopodium lucidulum porophilum
Phlox stolonifera†
Unifolium canadense

Fruiting yet to be observed

Aristida dichotoma
Asclepias Sullivantii
Cornus stolonifera
Fraxinus nigra
Fraxinus quadrangulata
Gentiana crinita
Lechea racemulosa
Lobelia leptostachys
Panicularia elongata
Parnassia caroliniana
Populus tremuloides
Psoralea Onobrychis
Rynchospora glomerata
Smilax ecirrhata

SUMMARY

Flowering scantily	8
Fruiting sparingly although flowering freely	10
Flowering freely, fruiting not observed	22
Fruiting freely	35
Fruiting freely, seedlings abundant	20
Pteridophytes, prothallia not observed	7
Abundant by vegetative propagation, species scattered through the above groups	7
Unobserved	14+11, 25
Total	134
Duplications	12
Net total	122

Such a classification to be of the maximum value should have been made by one familiar with the various species throughout the whole extent of their ranges. Species that appear to the writer to fruit abundantly may fruit so much more abundantly in other regions that their fruit in the Sugar Grove area would be scarce by comparison. The wintergreen, *Gaultheria procumbens*, is a case in point. The berries are apparently sufficiently common to supply enough seed for the perpetuation of the species, and the plant would accordingly have been classed as fruiting freely but for the acquaintance of the writer with the same species in New England where the berries are borne in such great profusion—six

† Species confined to the southern portion of the area.

or seven to a stalk—as to make the Ohio plants bearing rarely more than one or two berries and those only on about one plant in ten, seem sterile by comparison. On the other hand some

FIG. 5. *Oxydendrum arboreum* in fruit at Sugar Grove

species flower sparingly throughout their range so that similar behavior at the termini would not be unusual. In making the tables I have classed as fruiting freely all those species whose seed production appeared adequate for their perpetuation.

But allowing for all the changes which might be made in the classification by one of wider field experience than the writer, it seems certain that failure of the reproductive functions is an unimportant factor in the termination of ranges in this region. Most plants normally produce such an enormous quantity of surplus seed that even a considerable falling off in seed production would not necessarily affect the abundance of the species.

The success of the seedlings is apparently much more important than the number of seeds. *Rubus odoratus* is a case in point. Although flowers are produced in abundance the fruit does not set well so that it is usually difficult to find a berry perfect enough to be palatable. In the aboriginal forest this species led a precarious existence on the cliffs and other places unoccupied by trees, where sufficient light and moisture were obtainable. But with the destruction of the forest it is becoming one of the commonest plants of the ravines. It is clear therefore that its failure to fruit well is not a controlling factor in fixing its range.

Vegetative propagation plays of course a role of considerable importance in this connection. The most striking instances are *Phlox stolonifera*, *Unifolium canadense* and the lycopods which would hardly maintain themselves were it not for their stolons and gemmae.

On the other hand it seems safe to assign failure of the reproductive mechanism as the limiting factor in the case of those species which do not fruit well and at the same time are uncommon, being without means of vegetative multiplication. These include only *Asclepias Sullivantii*, *Aseculus octandra*, *Asclepias variegata*, *Blephariglottis lacera*, *Napaea dioica*, *Passiflora lutea*, *Quercus minor* (?), *Stylosanthes biflora* and the lycopods, *L. obscurum* and *L. clavatum*, which although forming large masses by their runners are yet scarce, especially the latter, of which only a single bed has been discovered.

The next question to arise is as to what differences in abundance there may be between the different geographical groups represented in the lists. What differences are there between northern and southern or eastern and western plants? A comparison of the lists given above with those presented in the preceding paper* gives the data shown in tabular form below.

* Griggs, Robert F. Observations on the geographical composition of the Sugar Grove flora. Bull. Torrey Club 40: 487–499. *f. 1–10.* 10 S 1913.

	Common	Common Few Stations	Abundant One Station	Rather Common	Per Cent. Common	Scarce	Rare	Per Cent. Uncommon	Unobserved	Flower Scantily	Fruit Sparingly	Per Cent. Not Fruiting Well	Flower Freely	Fruit Freely	Seedlings Abundant	Per Cent. Fruiting Well	Not Observed	Total
Alleghenian.....	18	0	1	4	65	4	4	22	7	5	5	28	6	9	5	53	9	39
New England Appalachian..	11	1	0	0	80	0	0	0	2	0	0	0	1	6	6	93	1	14
Appalachian....	7	4	0	0	92	0	0	0	1	1	0	8	1	4	3	66	3	12
Carolinian.....	16	2	0	5	68	2	3	15	4	2	4	18	6	11	3	61	6	32
Western.....	3	1	2	0	40	3	4	47	3	0	1	7	5	2	2	60	5	15
Northern.....	2	1	2	2	77	1	0	11	1	0	0	0	3	2	1	66	3	9

This table does not indicate that in this region species behave differently on different edges of their ranges. Except in one case the differences shown are too small to be significant in view of the small numbers involved. The abundance and reproduction of species terminating in this area are evidently matters concerned with the individual peculiarities of the particular species rather than with its geographical position. The large number of rare plants among those from the west is, however, very striking. When this is coupled with the fact that a large proportion of them are known from scattered stations far to the eastward of their main range, it becomes significant.

There is a widely held idea, which owes its origin I believe to Blytt* though it may be much older, that, whereas a species may be ubiquitous in the center of its range, occurring in all sorts of habitats because highly favored by climate, at its areal limits it will be closely limited to those conditions which are most favorable to it. According to this reasoning we should be best able to determine the conditions most favorable to any given species by observing its behavior on the edges of its range. The theory is so plausible that one would like to accept it and apply it to our plants. But unfortunately certain of our Sugar Grove plants do not seem to behave according to expectations and raise doubts concerning its validity.

The chestnut is one of the most typical of all the "calcifuge" plants and its distribution in central Ohio fulfils expectations in this regard. It is absent from the limestone country about Columbus but appears immediately as one enters the outcrops of sand-

* I am unable to find the reference to Blytt's paper; see also Cowles, Physiographic Ecology of Chicago and Vicinity. Bot. Gaz. 31: 83. 1901.

stone about twenty miles to the eastward. From this point it is abundant all over the sandstone part of the state and is one of the most important timber trees about Sugar Grove. What was

FIG. 6. *Rhododendron* at Sugar Grove. (Photograph by J. E. Hyde.)

my surprise then, on mapping its general range, to find its Michigan stations described in these terms by Beal:* "Occurs abundantly

* Beal, W. J. Michigan Flora 69. Lansing, 1904.

along an outcrop of Helderberg limestone in E. Monroe Co. and Wayne Co., C. F. Wheeler." Thus its preferences in one part of the edge of its range would make it a calciphile and in another part a calcifuge plant.

Rhododendron maximum is interesting in this connection. Its typical habitat is the densest shade in deep forests, where it forms impenetrable thickets. This for the most part is its habitat in the Sugar Grove area where it is found at the base of the cliffs in deep ravines on slopes with a northern exposure. In the northern section of the area immediately around Sugar Grove I have never seen it except in such situations. But in the southern section although likely habitats are common enough it is absent except for two isolated patches of small extent. One of these is near "Written Rock" on Clear Creek and the other is at the head of Laurel Run. In both of these stations the plant grows and apparently thrives measurably well as a crevice plant high up *on cliffs with extreme southern exposure* in conditions far different from its supposed optimum.

Aralia spinosa was almost exclusively a crevice plant in the primeval forest, occurring high up on the faces of the cliffs and dropping its seeds into the caves below where they sometimes took root, as in Old Man's Cave. Since the timber of the higher slopes has been cut off, the plant has multiplied extraordinarily until it has become a common pest on lumbered hillsides. The manuals credit it with growing in "Damp moist soil in the neighborhood of streams." But in the valley of Queer Creek only a single specimen and that dead, was found in the moist bottom land. Mohr* describes its habitat in Alabama as "Damp borders of woods and copses." Hilgard,† page 495, describes it as a lowland plant in highly productive calcareous soil and again, on page 515, states that with the *Liriodendron*, black walnut, Kentucky coffee tree, and others which are like it normally lowland plants, it may ascend in calcareous regions into the uplands as well. The rock in whose crevices it occurs in our area is not limestone but a pure sandstone which is sometimes quarried for glass sand; the hillsides which it has invaded are very poor land which was originally

* Mohr, Charles. Plant Life of Alabama. Cont. Nat. Herb. **6**: 640. 1901.

† Hilgard, E. W. Soils. Macmillan Co., 1904.

covered by a mixed forest of scrub and pitch pine, black oak and blueberries. Through the whole region much of the land has been abandoned and not more than half of the houses are now occupied. The crevices in exposed rocks are the poorest of all the habitats in the region and it can be shown that the majority of the chasmophytes are plants which have been crowded out of the more favorable habitats which they would quickly repopulate, as the *Aralia* has done, were their more successful neighbors removed. This very plant indeed, when the forest is removed, gives abundant evidence of the kind of habitat it prefers. It is really a *sun-loving* plant and grows only where sunlight is abundant. In the primeval forest the upper faces of the cliffs were the only situations in which a plentitude of light was available to a plant of such humble stature, so here it developed wherever together with sunlight sufficient water was present.

Even so few examples as these are sufficient to destroy the utility of the theory that at the edges of their ranges, species are confined to the most favorable habitats. Where it describes conditions previously known to obtain, well and good. But it cannot be generalized nor can it serve as a guide to the optimum habitats of plants whose preferences in this matter are unknown. Like much *a priori* reasoning it presents a conclusion which may be true rather than one which must be true. Moreover, another line of *a priori* reasoning might in this case lead us to diametrically opposite conclusions. In the center of its range a plant, being supposedly favored by all the conditions of its environment, is able to compete with other plants at an advantage and maintain a place for itself in various habitats. On its areal limits on the other hand environmental conditions are supposedly less favorable to this species than to others with which it will therefore be compelled to compete at a disadvantage. This may be brought about either by unfavorable physical conditions such as soil, climate, etc., or by the entry into the struggle for place of species absent from the center of the range which have an advantage over the given species in rapidity of growth or the like. The species in question is therefore driven out of the most favorable habitats and must find a place for itself where it can. This is exactly the situation of *Aralia spinosa* which in the dense forest

that originally covered the Sugar Grove region could grow only on the cliffs, where the successful forest trees could neither follow it nor deprive it of its light.

We seem, therefore, to have made little progress in the effort to determine the causes of the termination of ranges. The feeling that it was not caused by such factors as I could observe has also been borne in upon me as I have repeatedly studied the plants in the field. It has been quite impossible to imagine why a given species should be abundant in one valley and absent from the next one only a few miles away when all conditions seemed similar.

It is generally supposed that climatic influences are the most important factors in determining plant ranges. By appropriate manipulation of climatic data it is possible to draw striking parallels with vegetational zones. Thus Merriam* has constructed maps from temperature data which conform remarkably closely to the life zones of North America. Transeau† likewise by plotting the ratio of evaporation to rainfall has made a map conforming to the forest areas of eastern North America in scarcely less striking fashion. Although dealing with factors to a large extent unrelated to each other, the correspondence of each of these maps with biogeography is so striking as to lead almost irresistibly to the conclusion that each of them represents the causative factor. They are, however, admittedly made to fit the facts of distribution and have not the weight that they would possess if constructed *a priori* by someone unfamiliar with the biogeography of North America. Moreover, it is not possible to state with any confidence the climatic requirements of any given species.

If climate were the principal factor restricting the spread of plants the edges of their ranges should exhibit one of two conditions: (1) Since climate changes vary gradually from place to place the controlling conditions should appear very gradually and the plants in response finding the conditions of life more and more difficult should become scarcer and scarcer and finally fail. This, however, happens comparatively seldom in this region. (2) The range should be fringed with outliers occupying habitats

* Merriam, C. Hart. Laws of temperature control of the geographic distribution of terrestrial plants and animals. Nat. Geogr. Mag. 6: 229–238. 1894.

† Transeau, E. N. Forest centers of eastern America. Am. Nat. 39: 875–889. 1905.

where the climatic conditions were locally favorable. This is undoubtedly frequently the case. Bessey's* finding *Adiantum Capillus-veneris* near a hot spring in South Dakota is a notable example. The presence of *Betula lutea* and some other northern plants in the deep cold ravines of the present area may be set down rather confidently as a local instance. I would not dare, however, to apply this explanation to more than seven of the twenty-five outliers listed above; for the others it seems clearly out of the question.

For many of the plants which terminate here, especially those which I know best because their boundaries cross the area, it is quite beyond my power of analysis to discover any reason why they should find their limits where they do and not go a few miles further. The easiest explanation of my inability to fix upon the reason for the location of their termini is that there is no reason; that they do not occupy ranges fixed by climatic conditions but are in process of adjustment. Observation of these plants seems to indicate that competition with other plant species is more important than climate in fixing the limits of their ranges. The case may be best presented by a few concrete examples:

Silene rotundifolia is common in the crevices of rocks regardless of exposure (not on "shaded banks") throughout the southern section of our area whence it extends southward along the western slope of the mountains to Tennessee. It is common up to "Cantwell Cliffs" but here it suddenly stops and has never been found further north. Suitable habitats, however, are by no means lacking.

Aralia spinosa is another plant of this sort. This species is of such a character that he who travels the brush, whether he be botanist or not, is forcibly made aware of its presence wherever it grows. It is a common plant over most of the southern states reaching its northern limits in southern Illinois, the Sugar Grove area, and Pennsylvania. It is abundant in the valley of Queer Creek and in some places on Big Pine Creek, occurring on the higher slopes where the timber has been cut off. As already indicated its place in plant society has been greatly enlarged by the lumberman so that it is now much more common than formerly

* Bessey, C. E. One thousand miles for a fern. Asa Gray Bull. 8: 2–6. 1900.

and its seedlings are taking possession of many cut-over woods. But its terminus is perfectly sharp; not a single individual has been found further northward, although a constant lookout has been kept for it. The increase in available habitats is giving it a continuous range, whereas formerly it occupied only isolated stations in the crevices like *Silene rotundifolia*. This change greatly increases the chances of successful reproduction and the plant gives every evidence of spreading northward. But like *Silene* it has no special means of seed dispersal and its progress is very slow.

A large proportion of the western plants terminating here behave similarly. *Afzelia macrophylla*, for example, is rare in our area having been seen only once by the writer but under circumstances which clearly indicate its powers of invasion, for its seedlings were more than holding their own against the former occupants of the soil. The eastern edge of the range of these species consists of a circle of such outliers located where chance seeds have dropped in advance of the range. The large proportion of western plants which are rare with us and at the same time are known far beyond our area may indicate that these are not merely characteristics of the individual species but that there is a somewhat systematic migration of western plants eastward.

The converse of the same proposition is presented by such a plant as the hemlock, *Tsuga canadensis*. The main body of its range ends in the Sugar Grove region, where it is common, especially in the deepest canyons. It occurs in numerous outlying stations, however, far to the west and south. One of these is in the mountains of western Alabama;* another is on the Green River in Kentucky; a third,† which is better known, is near Greencastle, Indiana, where it occurs together with the yew on a limestone soil. Since it is usually found on rocks one might suppose that the causes of its termination were physiographic—the absence of suitable habitats in the intervening country. But although most often found on rocks, both sandstone and limestone, it is by no means a chasmophyte by preference but is at its best

* Mohr, C. Plant Life of Alabama. Cont. Nat. Herb. **6**: 34. 1901.

† Coulter, Stanley. Indiana Geol. Surv. Rep. **24**: 616. 1899. Since this paper was in type I have found that is by no means the only station in Indiana as is stated by Coulter.

in the richest of deep alluvial bottomland soils as in the canyon of Queer Creek in the southern section of the present area. In the northern section of the area, however, where the valleys are somewhat older in a physiographic sense, the hemlock is restricted to the rocks around the edges of the ravines while the bottom is occupied by a mixed *Liriodendron* forest. A study of the plant societies here has convinced me, however, that it once occupied the bottoms as it still does in the more inaccessible valleys further south, but that it has been driven out of the more favorable habitats by the hardwoods. It seems probable that it once ranged continously over all of Ohio and Indiana but that it has been displaced except in a few outlying rocky stations where it has been able to maintain itself till the present time. Study of the reproduction of the hemlock forest in the present area would indicate moreover that under present conditions, as modified by man, it will soon disappear from these stations as it has from the surrounding territory. On account of the superficial root-system, seedlings are unable to get a start except in very humid conditions such as obtained in the virgin forest. Wherever the humidity has been lowered by clearing, the hemlock seedlings are quickly dried out and killed both on rocks and in the bottom, while the hardwood trees which spring up beside them thrive where the soil is sufficiently deep.

The reasons for the increased abundance of such a plant as *Aralia spinosa* are of course not natural but artificial, introduced by the advent of man. On first thought one might be inclined to rule out such cases, but clearing and cultivation of the land make little if any change in climatic conditions. Their effect is in changing the conditions of competition between plant species. How profound this influence has been is forcibly brought to our attention every day by our pestiferous weeds, many of which are native species originally present in the forests but in insignificant numbers. All of these are species with some effective means of seed dispersal and their conquest of the country is now so complete that it is impossible to imagine their aboriginal condition. It is only the slow-moving species whose progress can be now studied.

That plant competition often plays a larger part than climatic influences is also indicated by the fact that most plants thrive

and successfully reproduce when planted under conditions widely different from those of their natural habitats if only competing plants are removed. Professor J. H. Schaffner informs me that *Cactus missouriensis* in Kansas at the eastern edge of its range is confined to the dry tops of the hills where nothing else can grow. But when he transplanted it to a rich shaded yard it grew far more rapidly than before and attained twice the size of wild specimens as long as grass was kept away from it.

The case of the hemlock is a good illustratiom of one very important factor which has not been touched on—the historical factor.* The reasons that the hemlock occupies its present range are primarily historical. It is here because this particular species and not some other analogous conifer like the Norway spruce was present in eastern North America during the Glacial Period and because it has not yet been completely displaced by the post-glacial flora. It occupies the canyon of Queer Creek not because it is better suited for that situation than any other plant of the region but simply because the invading hardwood forest has not had so good an opportunity to gain a foothold there as elsewhere.

There are thus apparently *tension zones* between different species somewhat similar to the familiar tension zones between plant societies. These zones are as critical in the study of plant geography as are formational tension zones in ecology. For in these zones it can be seen that some species are advancing while others are being beaten back. Just as one can determine the course of ecological succession from the behavior of plant societies in the tension zones so one can determine the trend of geographical movements† by a study of the tension zones at the edge of plant ranges.

And yet there can be no doubt that climatic conditions are of fundamental importance in determining the ranges of plants. It is apparent that plants tend to spread and would finally come to

* For a discussion of the importance of the historical factor, see Adams, C. C. The Postglacial dispersal of North American Biota. Biol. Bull. **9**: 53–71. 1905.

† Adams (Southeastern United States as a center of geographical distribution of flora and fauna. Biol. Bull. **3**: 115–131. 1902) has insisted that biogeography must be put on a dynamic basis. Bessey, C. E. (Plant migration studies. Univ. Neb. Studies **5**: 11–27. 1905) has shown that the forest trees are invading Nebraska from all sides, largely on account of the elimination of prairie fires.

occupy ranges as large as their adaptability to climate would permit, just as stream erosion would reduce all regions to base-level. Under such conditions competition between species would cease to be a factor, for that battle would have been finished and the weaker species eliminated. With competition would disappear the historical factor which is largely a record of the state of the struggle.

At best, however, such conditions obtain only for part of the plants. There are always a large number of species like the cactus cited above which are driven out of the favorable habitats by more aggressive plants but find a place in unfavorable stiuations where their competitors cannot follow them but which they can endure. Thus the plants of favorable habitats may be limited by climatic factors while those of unfavorable are largely controlled by competition. Accordingly one may find a species dominant at one edge of its range but outcast at the other. As one passes from zone to zone into more and more severe conditions he may find the outcast plants of one region becoming the dominant ones of the next, giving an appearance of complete adjustment to climatic conditions whereas in reality only half the vegetation is controlled by climate.

Where conditions have remained stable such adjustment should be found everywhere but as species approach the limits of their adaptability to climatic conditions their progress may be expected to be increasingly retarded so that as in base-leveling the last stages of the process are exceedingly slow. With our present limited knowledge of plant ranges it would be rash to suppose that complete climatic adjustment of vegetation is as rare as the completion of a cycle of erosion, but it is evident that various factors may intervene to disturb the process before completion. (1) The minor changes brought about by shifting physiography might affect the distribution of such plants as require certain peculiar habits. (2) Whenever and wherever new types of plants, or of animals that feed upon them, are evolved, their entry into the struggle for existence introduces an entirely different set of conditions and throws the whole vegetation* out of adjustment.

* Shreve in a paper entitled "The rôle of winter temperatures in determining the distribution of plants," read before the Botanical Society of America at Atlanta,

Changes of this character in the past are responsible for profound modifications of present phytogeography, such as the extinction of many types of conifers in the northern hemisphere. There is no reason for supposing that evolution has ceased or that its progress is so slow as to make its effect on plant competition unobservable. (3) We know very little about the rapidity of climatic changes but climatic revolutions in the past have wrought great changes in vegetation. It is hardly reasonable to suppose that such changes are not still going forward. It may be doubtful, perhaps, whether they are rapid enough to be discernible in the present day flora, but it is clear that exceedingly slow movements of vegetation may be readily detected by observations of the tension zones between the ranges.

Broad conclusions involving a systematic shifting of plant ranges cannot of course be drawn from study of a single area. But the behavior of the species reaching the edges of their ranges in the Sugar Grove area seems to indicate very clearly that the ranges terminating there are not fixed but are changing. Plants of boreal affinity are apparently being displaced by others from the west and south. This obviously falls into line with the biotic changes which are known to have occurred since the glacial period. The conditions of the tension zones between the species terminating at Sugar Grove find, therefore, their most rational interpretation as a present-day continuation of the floristic movements following the glacial period.

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31 D 1913, reported that the northward and altitudinal extension of the lowland flora in the vicinity of the Desert Botanical Laboratory is checked by winter temperatures. This would of course fall into line with other facts, such as extremely localized ranges and the rich development of endemic forms, which indicate for the flora of the southwest a great age as compared with the comparative youth of the flora of the northeastern states.

A taxonomic study of the Pteridophyta of the Hawaiian Islands—IV

WINIFRED J. ROBINSON

(WITH PLATES 1 AND 2)

LYCOPODIALES

Terrestrial or epiphytic plants with spores produced in sporangia borne in the axils of scale-like leaves.

Homosporous.
- Sporangia 1-celled. — LYCOPODIACEAE.
- Sporangia 2–3-celled. — PSILOTACEAE.

Heterosporous. — SELAGINELLACEAE.

LYCOPODIACEAE

Plants with upright or procumbent stems; leaves small, simple, crowded, in 2–several ranks upon the stem; sporangia in the axils of sporophylls, which may be leaf-like or scale-like, these in some species aggregated to form terminal strobili; spores yellow, numerous.

LYCOPODIUM L. Sp. Pl. 1100. 1753

Characters of the family.

Type species: *Lycopodium clavatum* L.

Vegetative leaves uniform.
- Sporophyls not aggregated in strobili; stems usually erect.
  - Stems tufted, often reddish; leaves coriaceous, entire, 6–8-ranked.
    - Leaves linear-lanceolate, patent, 8-ranked. — *L. erubescens.*
    - Leaves ovate-lanceolate, appressed, 6-ranked. — *L. Haleakalae.*
  - Stems not tufted, green; leaves membranaceous, finely serrate, 4–6-ranked. — *L. serratum.*
- Sporophyls aggregated in strobili; stems erect or pendulous.
  - Leaves membranaceous, 3-ranked. — *L. Phlegmaria.*
  - Leaves coriaceous, in more than 3 ranks.
    - Leaves 8-ranked; strobili simple, usually recurved. — *L. cernuum.*
    - Leaves 4–6-ranked; strobili often branched, not recurved.
      - Leaves linear-lanceolate, 6-ranked; sporophyls lanceolate, decreasing somewhat in size from base to apex of strobilus. — *L. nutans.*
      - Leaves lanceolate, 4–6-ranked; sporophyls broadly ovate, uniform in size. — *L. phyllanthum.*

Vegetative leaves not uniform.

Stems dorsi-ventral.	*L. volubile.*
Stems not dorsi-ventral.	
Sporophyls aggregated in terminal strobili.	*L. venustulum.*
Sporophyls not aggregated in terminal strobili.	*L. polytrichoides.*

LYCOPODIUM SERRATUM Thunb. Fl. Jap. 341. 1784

Lycopodium varium Mann, Proc. Am. Acad. 7: 221. 1866. Not Swartz.

Lycopodium sulcinervium Spring, Mém. Acad. Roy. Brux. 15: 39. 1842.

Lycopodium javanicum Sw. Syn. Fil. 175. 1810.

Lycopodium sargassifolium Liebm. Öfvers. Vid. Selsk. Förh. 1847: 41. 1847.

TYPE LOCALITY: Japan.

DISTRIBUTION: On tree trunks in forests at 700 m.–2200 m. elevation; Hawaiian Islands, Japan, India, Philippine Islands, Sumatra, Polynesia, Mexico.

ILLUSTRATIONS: Thunb. Fl. Jap. *pl. 38.* 1874. Hook. & Grev. Ic. Fil. *pl. 37.* 1874.

SPECIMENS EXAMINED: Hawaii, *Robinson 218* V; Oahu, *Heller 2904* C; *Forbes 1036* BM; *Forbes* BM; *Knudsen* B; *Robinson 196* V; Kauai, *Heller 2687* C; *Knudsen* B; *Robinson 414* V; *816* V.

Hillebrand's *L. serratum dentatum* (Hilleb. Fl. Haw. Is. 643. 1888) is represented by one small specimen from Lanai in the Berlin Herbarium; his *L. serratum subintegrum* by a single sterile shoot at Berlin. Forbes's specimen (no number) collected between Punahou and Kaipaupau, Oahu, corresponds with Hillebrand's description of the latter as to size and reddish color.

LYCOPODIUM ERUBESCENS Brack. Fil. U. S. Expl. Exped. 320. 1854

TYPE LOCALITY: Mount Haleakala, Maui, Hawaiian Islands.

DISTRIBUTION: In wet lands, at 2,000 m. elevation, Maui and Kauai, Hawaiian Islands.

ILLUSTRATION: Brack. Fil. U. S. Expl. Exped. *pl. 45.* 1854.

SPECIMENS EXAMINED: Hawaiian Islands, *Wilkes Expedition 1* B (type); *Wilkes Expedition* C; K.

This very compact form is well suited to the xerophytic conditions of the high altitudes where it is found.

LYCOPODIUM HALEAKALAE Brack. Fil. U. S. Expl. Exped. 312. *pl. 45.* 1854

TYPE LOCALITY: Eeka, W. Maui, Hawaiian Islands.

DISTRIBUTION: Type locality.

ILLUSTRATION: Brack. Fil. U. S. Expl. Exped. *pl. 45.* 1854.

SPECIMENS EXAMINED: *Hillebrand 153* B.

Hillebrand's specimen is small, but its obtuse, serrated leaves, with an incurved apex, and its greater rigidity distinguish it from *L. erubescens* Brack. and *L. compactum* Hook., which are its nearest allies.

Pritzel, E. &. P. Nat. Pflanzenfam. 1^4: 593. 1900, gives both *L. Haleakalae* and *L. erubescens* as varieties of *L. suberectum* Lowe, but they differ from each other sufficiently to establish their origin from different species at least, if change of habitat should prove that their alpine characters are not specific.

LYCOPODIUM PHLEGMARIA L. Sp. Pl. 1101. 1753

TYPE LOCALITY: India.

DISTRIBUTION: India, Australia, Pacific Islands, Mauritius.

ILLUSTRATIONS: Breyne, Exot. Cent. *pl. 92.* 1678. E. & P. Nat. Pflanzenfam. 1^4: 600. *f. 377.* 1900.

SPECIMENS EXAMINED: Maui, *Mann* B.

The specimen examined is more slender than the Indian forms, but the material available does not warrant the establishment of a new species.

LYCOPODIUM CERNUUM L. Sp. Pl. 1103. 1753

Lycopodium curvatum Gaud. Voy. Freyc. Bot. 284. 1828.

TYPE LOCALITY: India.

DISTRIBUTION: Common in thickets at the edge of forests in the tropics.

ILLUSTRATIONS: Dill. Hist. Musc. *pl. 63.* 1741. E. &. P. Nat. Pflanzenfam. 1^4: 603. *f. 379.* 1900.

SPECIMENS EXAMINED: Maui, *Robinson 398* V; Oahu, *Forbes* BM; *Hillebrand* B; *Robinson 53* V; *95* V; *197* V; *Seemann 1705* B; Kauai, *Heller 2596* C; *Knudsen 186* B; Hawaiian Islands, *Hillebrand* B; *Miss Sessions* C.

The specimens of *L. cernuum* in the Hillebrand collection in

the Berlin Herbarium are there separated into two species, *L. crassifolium* and *L. capillaceum*, the former of which is the more robust. It is difficult, however, to determine constant characters which may be termed diagnostic, whether one tries to separate the plants into two species as at Berlin or into seven with Müller (Bot. Zeit. **19**: 161. 1861).

LYCOPODIUM NUTANS Brack. Fil. U. S. Expl. Exped. 327. 1854

TYPE LOCALITY: Oahu, Hawaiian Islands.

DISTRIBUTION: On trees, at 600 m.–1,000 m. elevation, rare, Hawaiian Islands.

ILLUSTRATIONS: Brack. Fil. U. S. Expl. Exped. *pl. 46.* 1854. PLATE 1.

SPECIMENS EXAMINED: Oahu, Nuuanu Valley, *Hillebrand* B; *Robinson 199* V; W. Maui, Wailua Valley, *Hillebrand* B.

The conspicuous difference between the slender fertile portion which terminates the branch and the broad sterile portion with its stiff coriaceous linear-lanceolate leaves, gives the distinguishing feature which separates *L. nutans* from *L. squarrosum* Forst. In the latter, the transition is gradual between the sterile and fertile areas.

Brackenridge in describing *L. nutans* as a new species closely related to *L. phyllanthum* Hook. & Arn. says: "This is one of the most robust species of the genus. It is very well distinguished from the preceding (*L. phyllanthum*) by its stouter stem, and its thick, nodding spikes; the leaves on the stems also are more crowded and the scales of the spikes are of considerably greater length."

LYCOPODIUM PHYLLANTHUM Hook. & Arn. Bot. Beech. 102. 1832

Lycopodium pachystachyon var. *β phyllanthon* Spring, Mém. Acad. Brux. **24**: 29. 1848.

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: Pendulous on trees; Hawaiian Islands, Tahiti, Samoa, Borneo, Java, India.

ILLUSTRATION: PLATE 2.

SPECIMENS EXAMINED: Hawaii, *Robinson 263* V; Maui, *Robinson 389* V; Oahu, *Heller 2182* C; *Hillebrand* B; *Knudsen 29* B;

Kuntze C; *Robinson 445* V; Lauai, *Hillebrand* B; Hawaiian Is., *Forbes* BM; *Lindley* C; *Wilkes Expedition* C.

L. phyllanthum has very nearly related species in the Indian *L. macrostachys* Spring, Mém. Acad. Brux. 24: 30. 1848, and in the Philippine specimens *Williams 573* C and *Williams 2916* C. In most of the Hawaiian specimens, the diameter of the fertile portion is greater than it is in the Indian or Philippine plants.

In none of the specimens examined by the writer were the upper sporophyls of the strobilus "barren and larger, approaching the form of true leaves" as described by Hooker and Arnott (l. c.) but in the Philippine specimens mentioned above the strobilus was somewhat foliaceous.

LYCOPODIUM VOLUBILE Forst. Prod. 86. 1781

TYPE LOCALITY: Australia.

DISTRIBUTION: Australia, New Zealand, Hawaiian, Viti, and Society Islands.

SPECIMENS EXAMINED: Hawaiian Islands, *Menzies* K.

This species is interesting because it resembles *Selaginella* in dimorphic sterile leaves, but has the fertile spike of a true *Lycopodium*. Menzies is the only collector known to have found it, and his specimen probably came from Mauna Kea, Hawaii.

LYCOPODIUM VENUSTULUM Gaud. Voy. Freyc. Bot. 283. *pl. 22.* 1828

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: At elevations of 800 m.–1200 m., Hawaiian Islands.

ILLUSTRATION: Gaud. Voy. Freyc. Bot. *pl. 22.* 1828.

SPECIMENS EXAMINED: Oahu, *Forbes* BM; Hawaiian Is., *Hillebrand* B; *128* K; *Wilkes Expedition* B; *24* C; K; *26* C.

One of the specimens collected by the Wilkes Expedition, *26* C, is reduced in size and has fewer branches from the horizontal stem proportionately than the normal form, *Wilkes 24* C. This doubtless grew at a higher elevation or in a more exposed locality than is usual for the species. Hillebrand makes it a variety, *L. venustulum* var. *herpeticum*, but it is not worthy of specific rank.

LYCOPODIUM POLYTRICHOIDES Kaulf. Enum. Fil. 6. 1824

TYPE LOCALITY: Oahu, Hawaiian Islands.

DISTRIBUTION: On trees, at 600–1,000 m. elevation, Hawaiian Islands.

SPECIMENS EXAMINED: Oahu, *Chamisso* B (type); Oahu, Mopala Valley, Kaala Mts., *Forbes* BM; Waiolaui Valley, *Forbes* BM; Konahuanui, *Heller* C; Kaala Mts., *Hillebrand* B; *Martens* B; Molokai, *Hillebrand* B; Kauai, *Knudsen 34* B; Hawaiian Islands, *Hillebrand 594* B; *598* B; *Menzies* K; *Wilkes Expedition* K.

Chamisso's type is a slender plant about 15 cm. high, while Hillebrand's specimen from Molokai is much branched and about 40 cm. high. The others range between these. All, however, agree in the open angles of the branching, and in the many-ranked aculeate leaves, which bear sporangia in the last two or three divisions of the stem.

PSILOTACEAE

Represented in the Hawaiian Islands by the single genus *Psilotum*.

PSILOTUM Sw. Syn. Fil. 187. 1806

Epiphytic or occasionally terrestrial plants; stems upright; roots fleshy; leaves small, scale-like, the sterile simple, the fertile bifid; sporangia borne in the axils of the leaves, 3-celled, opening by three valves from the apex; spores minute, yellow.

Type species: *Lycopodium nudum* L.

Stems triangular; sterile leaves aculeate, minute.	*P. nudum.*
Stems flattened; sterile leaves obtuse.	*P. complanatum.*

PSILOTUM NUDUM (L.) Griseb. Abh. Kön. Gesell. Wiss. Göttingen 7: 278. 1857

Lycopodium nudum L. Sp. Pl. 1100. 1753.

Hoffmannia aphylla Willd. in Römer & Ust. Mag. Bot. 6: 17. 1789.

Bernhardia dichotoma Willd. in Schrift. Acad. Erfurt. 1802: 11. 1802.

Psilotum triquetrum Sw. Syn. Fil. 187. 1806.

Psilotum oahuensis Müller, Bot. Zeit. 14: 238. 1856.

TYPE LOCALITY: Jamaica, B. W. I.

DISTRIBUTION: On ground and on trees, in tropical countries.

ILLUSTRATIONS: Schkuhr, Krypt. Gew. *pl. 165b.* 1809; Plum. Foug. Am. *pl. 170 f. a.* 1705; Dill. Hist. Musc. *pl. 64. f. 4.* 1741 (Dillenius probably never saw the specimen but seems to have copied Plumier's figure).

SPECIMENS EXAMINED: Hawaii, *Robinson 264* V; Maui, *Robinson 313* V; *351* V; Oahu, *Eschscholz* K; *Wilkes Expedition* N; *Heller 1989* C; K; N; *Mann & Brigham 140* N; *Seemann 1723* K; Hawaiian Is., *Wilkes Expedition* C; N; *Lindley* C; *Macrae* K.

PSILOTUM COMPLANATUM Sw. Syn. Fil. 188. 1806

Muscus clavatus Bauhin. Pinax. 360. 1671.
Lycopodium Sabinae-facie Dill. Hist. Musc. 445. 1741.
Lycopodium digitatum Dill. Hist. Musc. 448. 1741.
Lycopodium complanatum L. Sp. Pl. 1104. 1753.
Bernhardia ramulosa Müller, Bot. Zeit. 14: 222. 1856.

TYPE LOCALITY: Jamaica, B. W. I.

DISTRIBUTION: On trees, West Indies, Malaysia, Polynesia, and Hawaiian Islands.

ILLUSTRATIONS: Dill. Hist. Musc. *pl. 59. f. 3.* 1741. Sw. Syn. Fil. *pl. 4. f. 5.* 1806. Schkuhr, Krypt. Gew. *pl. 165b.* 1809.

SPECIMENS EXAMINED: Oahu, *Robinson 11* V; *20* V; *Wilkes Expedition* N; Kaala Mts., *Wilkes Expedition* N; *Heller 2216* C; K; N; Ex Herb. Hooker C; *Hillebrand 118* K; *Macrae* C.

SELAGINELLACEAE

Plants with upright or procumbent, usually dorsi-ventral, dichotomous stems, one branch exceeding the other in growth; leaves uniform or dimorphous, in the latter case forming a mosaic, the lateral leaves extending horizontally from either side of the stem, the intermediate leaves closely applied to the stem; sporophyls borne at the ends of the branches usually forming strobili, in which the few macrosporangia are in the axils of the basal sporophyls, the more numerous microsporangia in the axils of the terminal sporophyls.

SELAGINELLA Beauv. Prod. 101. 1805

Characters of the family.

Type species: *Lycopodium selaginoides* L.

Vegetative leaves uniform; spores rough. *S. deflexa.*
Vegetative leaves not uniform; spores smooth.

Leaves imbricated; stems 20 cm. or less in length.	*S. arbuscula.*
Leaves not imbricated; stems more than 20 cm. long.	
Branching flabellate; megasporangia 3-valved.	*S. Menziesii*
Branching pinnate or apparently so; megasporangia 2-valved.	*S. Springii.*

SELAGINELLA DEFLEXA Brack. Fil. U. S. Expl. Exped. 332. 1854

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: Rare, on trees, at elevations of 600–2,000 m., Hawaiian Islands.

ILLUSTRATION: Brack. Fil. U. S. Expl. Exped. *pl. 45.* 1854.

SPECIMENS EXAMINED: Maui (Mt. Eeka) *Hillebrand* B; C; Molokai (Wailau) *Hillebrand* B; Kauai, *Hillebrand* K; *Knudsen* B; *Johnson* B.

S. deflexa is easily distinguished from *Lycopodium serratum* by its backwardly directed spinulose leaves and the shortness of the leaves at the base of the stem which give the shoot the appearance of an inverted cone.

SELAGINELLA ARBUSCULA Spring, Mém. Acad. Brux. **24**: 183. 1848

Lycopodium arbuscula Kaulf. Enum. Fil. 19. 1824.

Lycopodium pennigerum Gaud. Voy. Freyc. Bot. 288. 1828.

TYPE LOCALITY: Oahu, Hawaiian Islands.

DISTRIBUTION; Hawaiian Islands.

SPECIMENS EXAMINED: Hawaii, *Hillebrand* B; *Robinson 269* V; Oahu, *Diell* C; *Heller 1993* C; (Nuuanu) *Hillebrand* B; (Kahaua) *Hillebrand* B; *Meyen* B; (Hillebrand's Glen) *Robinson 121* V; *184* V; Hawaiian Is., *Gaudichaud* B; *Macrae* K; *Wilkes Expedition* C; Ex Herb. Kew. C.

The small size of the plants and the closely crowded leaves distinguish *S. arbuscula* from the other species usually found growing with it.

SELAGINELLA MENZIESII Spring, Mém. Acad. Brux. **24**: 185. 1848

Lycopodium Menziesii Hook. Bot. Misc. **2**: 390. 1831.

Selaginella flabellata Underw. Minn. Bot. Stud. 1^4: 793. 1896. Not Spring.

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: In mountain forests, Hawaiian, Samoan, and Fiji Islands.

ILLUSTRATION: Hook. & Grev. Ic. Fil. *pl. 200.* 1831.

SPECIMENS EXAMINED: Maui, *Robinson 723* V; Oahu, *Douglas 30* K; *Forbes 1016* BM; (Makaha Valley) BM; (Konahuanui) BM; (Kaipaupau) BM; *Hillebrand* B; *Menzies* K; *Wilkes Expedition 5* C; Kauai, *Heller 2499* C; *2558* C.

The darker color, and proportionately broader form distinguish this from *S. Springii*, notwithstanding the close relationship existing between *S. Menziesii*, *S. flabellata*, and *S. Springii*.

SELAGINELLA SPRINGII Gaud. Voy. Bonite Bot. Crypt. 340. 1846

Selaginella Menziesii Baker, Fern Allies 97. 1887. Not Spring, Mém. Acad. Brux. **24**: 185. 1848.

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: In moist localities, at elevations of 600–800 m., Hawaiian Islands.

ILLUSTRATION: Gaud. Voy. Bonite Bot. Crypt. *pl. 12*. 1846–9.

SPECIMENS EXAMINED: Maui (Waihee) *Hillebrand* B; (Lahaina) *Hillebrand* B; *Robinson 704* V; Molokai (Wailau) *Hillebrand* B; Oahu, *Forbes* BM; *Chamisso* B; *Heller 2009* C; *2180* C; *Robinson 522* V; *528* V; Ex Herb. Mt. Holyoke College C.

Baker (Fern Allies 97. 1887) and Hieronymus (Nat. Pflanzenfam. 1^4: 678. 1901) both speak of the intergrading forms between *S. Springii* and *S. Menziesii*. The latter, however, recognizes *S. Springii* as a species distinct from *S. Menziesii* though closely related to it. It would not be remarkable if crosses had frequently occurred between these two forms which grow upon wet rocks where there is every facility for such hybridization.

The teeth at the base of the anterior margin of the stem leaves are longer than those of the apical portion, but hardly slender enough to be regarded as cilia as Gaudichaud figures them.

SPECIES INQUIRENDA

SELAGINELLA PARVULA Hilleb. Fl. Haw. Is. 648. 1888

TYPE LOCALITY: Hawaiian Islands.

DISTRIBUTION: Oahu (Nuuanu Valley), Hawaiian Islands.

Hillebrand in a footnote to his description of *S. parvula* suggests that it may be a young form of *S. arbuscula*, a suggestion which seems very probably true, from the close similarity of the two plants and the fact that only the one collection of the material has been made.

INDEX TO AMERICAN BOTANICAL LITERATURE

1907–1913

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card issue should be addressed to the Treasurer of the Torrey Botanical Club.

Andrews, A. L. Notes on North American *Sphagnum*—V. Bryologist **16**: 74–76. S 1913.

Barrett, O. W. Some new or little-known Philippine economics. Philip. Agr. Rev. **6**: 493–503. *pl. 2–11.* O 1913.

Bates, J. A. My herbarium and its one enemy. Am. Fern Jour. **3**: 49–52. 12 Je 1913.

Benedict, R. C. *Schizaea pusilla* in its natural surroundings. Am. Fern Jour. **3**: 11–13. *pl. 1.* 22 Mr 1913.

Berger, [A.]. Eine neue *Agave*. *Agave Vilmoriniana* Berger nov. spec. Repert. Sp. Nov. **12**: 503. 1 N 1913.
From Mexico.

Berry, E. W. Some paleontological results of the Swedish South Polar Expedition under Nordenskiold. Science II. **38**: 656–661. 7 N 1913.

Bicknell, E. P. The ferns and flowering plants of Nantucket—XI. Bull. Torrey Club **40**: 605–624. 24 N 1913.
Includes *Hypericum dissimulatum* and *Crocanthemum dumosum*, spp. nov.

Bicknell, E. P. The heather, *Calluna vulgaris*, on Martha's Vineyard. Rhodora **15**: 189–192. 17 N 1913.

Bitter, G. Solana nova vel minus cognita. XII. Repert. Sp. Nov. **12**: 433–468. 1 N 1913.
Includes ten new species and many new varieties.

Bitter, G. Über verschiedene Varietäten der *Polylepis australis*. Repert. Sp. Nov. **12**: 477–479. 1 N 1913.
Includes new varieties from Argentina.

Blake, S. F. Six weeks' botanizing in Vermont—I. Notes on the plants of the Burlington region. Rhodora **15**: 154–168. 1 S 1913.—II. Additional notes on plants near Burlington. Rhodora **15**: 200, 201. 17 N 1913.

Blanchard, F. N. Two new species of *Stigonema*. Rhodora **15**: 192–200. *pl. 105*. 17 N 1913.
Stigonema anomalum and *S. medium*, spp. nov.

Brannon, M. A. Osmotic pressure in potatoes. Bot. Gaz. **56**: 433–438. *f. 1–4*. 15 N 1913.

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Chapman, G. H. "Mosaic" and allied diseases, with especial reference to tobacco and tomatoes. Ann. Rep. Massachusetts Agr. Exp. Sta. **25**: 41–51. Ja 1913.

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Includes *Oenothera Hookeri Hewetti* subsp. nov.

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Fernald, M. L. A new station for *Scirpus Longii*. Rhodora **15**: 202. 17 N 1913.

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Gandara, D. Técnica para hacer preparaciones microscópicas según el sistema de los laboratorios de los Estados Unidos. Mem. y Rev. Soc. Cien. "Antonio Alzate" **32**: 201–207. Au 1912.

Gandara, G. Las Ustilagíneas y las Uredíneas deben elevarse á la categoría de ordenes llamándoles Ustilagomicetos y Uredinomicetos, respectivamente. Mem. y Rev. Soc. Cien. "Antonio Alzate" **32**: 213–217. Au 1912.

Gandara, G. Visita á algunas instituciones de botánica y parasitología agrícola de los Estados Unidos. Mem. y Rev. Soc. Cien. "Antonio Alzate" **30**: 341–365. Jl 1911.

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Hassler, E. Novitates argentinae—III. Repert. Sp. Nov. **12**: 495–499. 1 N 1913.

Includes *Abutilon Lilloi, A. saltense,* and *A. jujuiense,* spp. nov.

Hewitt, J. L. *Puccinia pruni-spinosa* killing plum nursery stock. Phytopathology **3**: 270. O 1913.

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Jennings, O. E. Notes on the pteridophytes of the north shore of Lake Superior. Am. Fern Jour. **3**: 38–47. 12 Je 1913.

Kunkel, O. The influence of starch, peptone, and sugars on the toxicity of various nitrates to *Monilia sitophila* (Mont.) Sacc. Bull. Torrey Club **40**: 625–639. 24 N 1913.

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Miyake, K. The influence of salts common in alkali soils upon the growth of the rice plant. Jour. Biol. Chem. **16**: 235–263. N 1913.

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Ochoterena, I. Opuntes para el estudio de las cactaceas mexicanas. Mem. y Rev. Soc. Cien. "Antonio Alzate" **31**: 153–199. *f. 1–20.* Jl 1911.

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Palla, E. Neue Cyperaceen. Öst. Bot. Zeits. **63**: 401–404. O 1913.
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Printed in advance from Carnegie Inst. Publ. 193.

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Quehl, L. Die Behandlung des *Cereus grandiflorus* Mill. Monats. Kakteenk. **23**: 145. 15 O 1913.

Ransier, H. E. Hunting the hart's tongue and holly fern at Owen Sound, Ontario. Am. Fern Jour. **3**: 25–37. *pl. 1 + f. 1–8.* 12 Je 1913.

Rehm, H. Ascomycetes exs. fasc. 53. Ann. Myc. **11**: 391–395. 10 N 1913.
Includes American material.

Rehm, H. Ascomycetes novi. Ann. Myc. **11**: 396–401. 10 N 1913.
Includes *Pezizella dakotensis, Phomatospora Rosae, Plicaria glacialis, Dasyscypha Ivae, Sphaerulina divergens, Leptosphaeria Onagrae,* spp. nov. from America.

Robinson, B. L. Diagnoses and transfers among the spermatophytes. Proc. Am. Acad. Sci. **49**: 502–517. O 1913.

Includes *Inga Peckii, Acacia bucerophora, Aeschynomene tenerrima, Linociera oblanceolata, Strychnos Peckii, Gymnolomia acuminata, Flourensia retinophylla,* and *Trixis calcicola,* spp. nov., and numerous new combinations.

Robinson, B. L. A generic key to the Compositae-Eupatorieae. Proc. Am. Acad. Arts and Sci. **49**: 429–437. O 1913.

Robinson, B. L. Revisions of *Alomia, Ageratum,* and *Oxylobus.* Proc. Am. Acad. Arts and Sci. **49**: 438–491. O 1913.

Includes *Alomia guatemalensis, A. platylepis, Ageratum platypodum, A. riparium,* and *A. elachycarpum,* spp. nov., and various new forms, varieties, and names.

Rosenstock, E. Filices novae a cl. Dr. O. Buchtien in Bolivia collectae. Repert. Sp. Nov. **12**: 468–477. 1 N 1913.

Includes eleven new species in *Asplenium* (3), *Diplazium* (2), *Dryopteris* (2), *Polypodium* (1), and *Elaphoglossum* (5).

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Currant rust, white pine blister rust.

Stone, G. E. Effects of illuminating gas on vegetation. Ann. Rep. Massachusetts Exp. Sta. **25**: 45–60. *f. 1–3.* Ja 1913.

Stone, G. E. The influence of various light intensities and soil moisture on the growth of cucumbers, and their susceptibility to burning from hydrocyanic acid gas. Ann. Rep. Massachusetts Agr. Exp. Sta. **25**: 61–72. *f. 1–2.* Ja 1913.

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Stuchlik, J. Generis *Gomphrenae* species exclusae. Repert. Sp. Nov. **12**: 350–359. 1 S 1913.

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Swingle, W. T. *Citrus ichangensis*, a promising, hardy, new species from southwestern China and Assam. Jour. Agr. Research **1**: 1–14. *pl. 1 + f. 1–7.* 10 O 1913.

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Includes *Asterina Miconiae* sp. nov. from Brazil.

Theissen, F. *Hemisphaeriales*. Ann. Myc. **11**: 468, 469. 10 N 1913.

Thom, C., & Currie, J. N. The dominance of Roquefort mould in cheese. Jour. Biol. Chem. **15**: 249–258. *f. 1.* 2 Au 1913.

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Vaupel, F. Die Gattung *Epiphyllum* und ihre Verwandten. Monats. Kakteenk. **23**: 114–118. 15 Au 1913.

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Weir, J. R. An epidemic of needle diseases in Idaho and western Montana. Phytopathology **3**: 252, 253. Au 1913.

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